Babcock

HANDBOOK

SIGNAL GENERATOR

BSG-7

(BABCOCK)

BABCOCK RADIO ENGINEERING, INC.

1640 MONROVIA AVE. • P.O. BOX 344 • COSTA MESA, CALIF.

HANDBOOK

SIGNAL GENERATOR

BSG-7

(BABCOCK)

TABLE OF CONTENTS

Section		Page
I	GENERAL DESCRIPTION	
	1-1. Purpose of Handbook	2
	1-4. Purpose of Equipment	2
	1-6. Basic Theory of Operation	2
	1-14. Physical Description of Signal Generator BSG-7	6
	1-18. Electrical Characteristics	8
	1-20. Electron Tube, Fuse, and Indicator Lamp Complement	9
II	OPERATION	
	2-1. Functions of Operating Controls and Indicators	11
	2-3. Operational Precautions	13
	2-5. Operation of the Signal Generator BSG-7	14
III	TEST EQUIPMENT	
	3-1. Recommended Test Equipment	20
	3-3. Special Test Oscillator	20
IV	MAINTENANCE	
	4-1. Inspections	23
	4-4. Bench Test of the Signal Generator BSG-7	24
	4-5. Check of R-F Output Frequencies	24
	4-6. Check of R-F Output Level	27
	4-7. Check of Internal Modulation Oscillator Frequencies	28
	4-8. Check of Internal Modulation Oscillator Output Levels	30
	4-9. Check of Deviation Meter Circuit Input Level	30

TABLE OF CONTENTS (cont)

Section		Page
IV	MAINTENANCE (cont)	
	4-10. Check of Frequency Deviation Level and Phase Modulation Linearity	32
	4-11. Trouble Shooting	36
	4-13. Preliminary Checks	36
	4-14. Disassembly of the Signal Generator BSG-7	44
	4-17. Reassembly of the Signal Generator BSG-7	49
	4-18. Alignment and Adjustments	49
	4-20. Testing and Preliminary Alignment of the R-F Exciter Chassis	49
	4-21. Testing and Preliminary Alignment of the R-F Output Chassis	50
	4-22. Adjustment of Internal Modulation Oscillator Frequencies	54
	4-23. Adjustment of Internal Modulation Oscillator Output Levels	55
	4-24. Adjustment to Obtain Proper Frequency Deviation Linearity	56
	4-25. Adjustment of RF Output Meter M-102 Circuit	60
	4-26. Final Adjustment of R-F Output Frequencies	61
	4-27. Cleaning and Lubrication	62
V	DIAGRAMS	
	5-1. General	75

ILLUSTRATIONS

Figure		Page
1-1.	Signal Generator BSG-7, Equipment Supplied	1
1-2.	Signal Generator BSG-7, Functional Block Diagram	3
2-1.	Signal Generator BSG-7, Front Panel View	10
3-1.	Suggested Test Oscillator, Schematic Wiring Diagram	21
4-1.	Bench Test Diagram for Check of R-f Frequencies and Output Levels	25
4-2.	Bench Test Diagram for Check of Internal Modulation Oscillator Frequencies and Output Levels	29
4-3.	Bench Test Diagram for Check of Modulation Linearity at Frequencies above 7500 Cps	31
4-4.	Bench Test Diagram for Check of Modulation Linearity at Frequencies Below 7500 Cps	33
4-5.	Bench Test Diagram for Preliminary Alingment of R-f Exciter Subassembly	48
4-6.	Bench Test Diagram for Preliminary Alignment of R-f Output Subassembly	51
4-7.	Signal Generator BSG-7, Front Panel View, Component Locations	65
4-8.	Signal Generator BSG-7, Top View, Component Locations	66
4-9.	Signal Generator BSG-7, Bottom View, Component Locations	67
4-10.	R-F Exciter Chassis, Component Locations	68
4-11.	R-F Output Chassis, Component Locations	69
4-12.	Gain Control Board Assembly, Component Locations	70
4-13.	Metering Board Assembly, Component Locations	71

ILLUSTRATIONS (cont)

Figure		Page
4-14.	Grid Board Assembly, Component Location.....	72
4-15.	Audio Oscillator Assembly, Exploded View, Component Locations.....	73
4-16.	Audio Mixer Assembly, Exploded View, Component Locations.....	74
5-1.	Signal Generator BSG-7, Schematic Wiring Diagram.....	76
5-2.	Signal Generator BSG-7, Terminal Voltage Diagram.....	77
5-3.	Signal Generator BSG-7, Terminal Resistance Diagram....	78
5-4.	Signal Generator BSG-7, Terminal Resistance Diagram for Connectors	79

TABLES

Table	Title	Page
1-1.	Electrical Characteristics	8
1-2.	Quantity and Types of Electron Tubes, Fuses, and Indicator Lamps Required	9
3-1.	Test Equipment Recommended for Service and Overhaul	20
4-1.	R-F Output Frequency Tolerance Chart	27
4-2.	Internal Modulation Oscillator Frequency Tolerance Chart	28
4-3.	Deviation Linearity Chart for Frequencies Above 7500 Cps	35
4-4.	Deviation Linearity Chart for Frequencies Below 7500 Cps	35
4-5.	Signal Generator BSG-7 Trouble Shooting Chart	38

Figure 1-1. Signal Generator BSG-7, Equipment Supplied

SECTION I

GENERAL DESCRIPTION

1-1. PURPOSE OF HANDBOOK.

1-2. This publication is issued as the basic Handbook for the Signal Generator BSG-7.

1-3. This handbook contains descriptive data and illustrated instructions which are designed to facilitate operation and maintenance of the subject equipment. Information relative to adjustment, operation, theory of operation and maintenance is contained herein.

1-4. PURPOSE OF EQUIPMENT.

1-5. The Signal Generator BSG-7 is primarily designed as a test generator for radio receivers. The Signal Generator can be used to test FM receivers operating in the range of 406 to 420 megacycles, using carrier deviations up to ±300 kilocycles. The Signal Generator is a portable instrument providing frequency modulated r-f carrier signals of accurately known frequency and amplitude. Although designed as a laboratory standard, the Signal Generator is sufficiently flexible to permit use in production testing or field maintenance of FM equipment operating in the aforementioned range of frequency and deviation.

1-6. BASIC THEORY OF OPERATION.

1-7. GENERAL. (See figure 1-2.) The Signal Generator BSG-7 consists essentially of two r-f sections, a deviation control section, a deviation metering section, an a-f modulation section and a power supply section. Basic operational principles of these sections are as follows. (See figure 5-1.)

1-8. OUTPUT R-F SECTION. Electron tube V-301 functions as a crystal oscillator and produces an output frequency dependent upon the selection of crystals. Any one

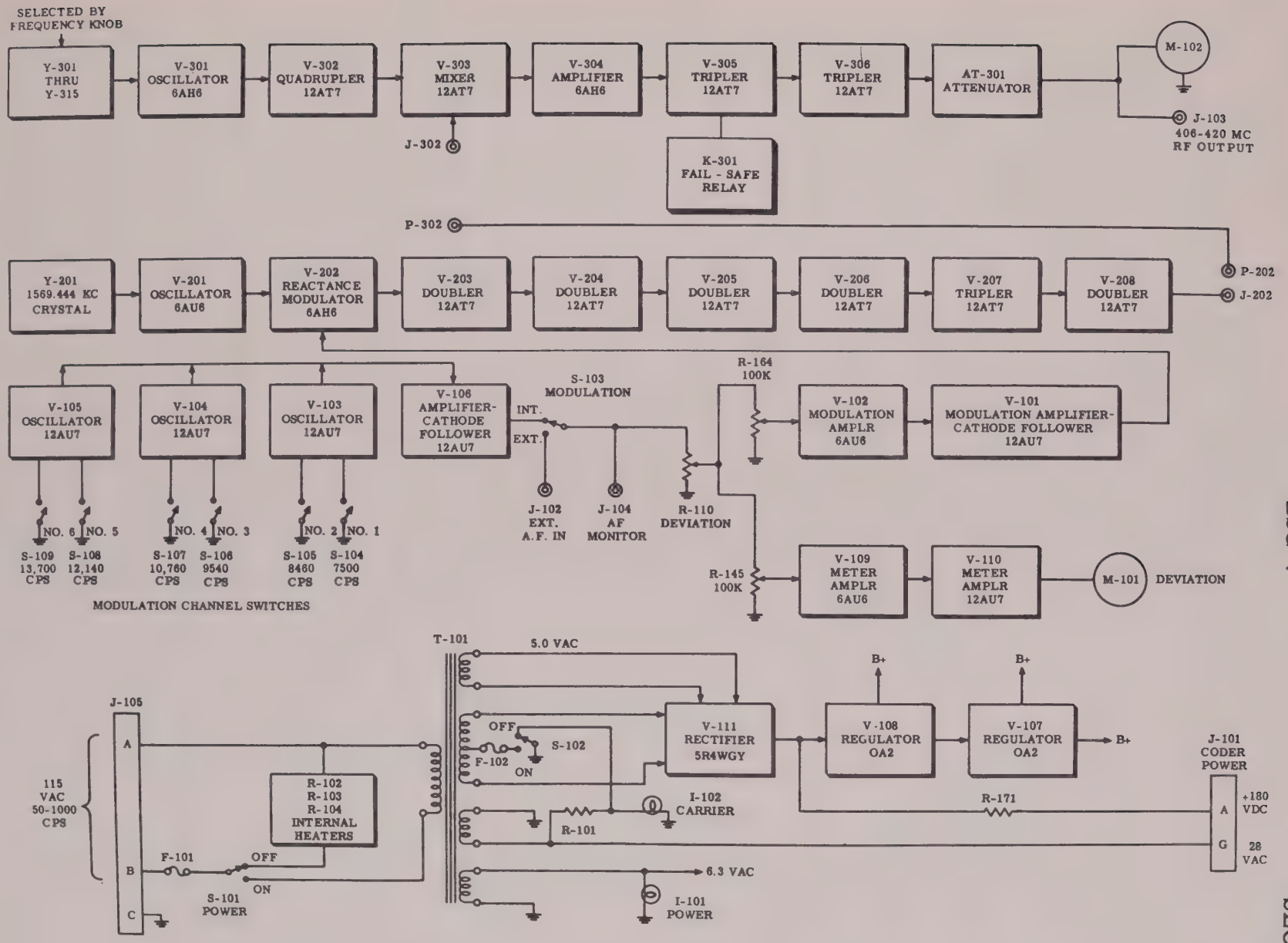


Figure 1-2. Signal Generator BSG-7, Functional Block Diagram

of 15 crystals can be selected by the FREQUENCY knob. The output from V-301 is applied to V-302 where it is quadrupled. The output from V-302 is combined with an output from the exciter r-f section in mixer stage V-303. Electron tube V-304 amplifies the difference frequency signal from V-303 and delivers its output to V-305 where the frequency is tripled. Final tripler stage V-306 is driven by V-305 and delivers its output through the attenuation control AT-301. The 406 to 420 megacycle output from AT-301 is applied to the R.F. OUTPUT receptacle J-103 through a 52 ohm impedance network and to the RF OUTPUT meter through a crystal rectifier and meter adjustment circuit. The output r-f section is provided with a fail-safe circuit to prevent damage to electron tubes in case of grid drive loss. The fail-safe circuit consists essentially of relay K-301 and associated parts. The grid drive potential appearing on electron tube V-305 is applied to the coil of K-301. The B+ potential for electron tubes V-302 through V-306 is passed through the contacts of K-301. So long as grid drive is present, the coil of K-301 remains energized and the contacts remain closed. Should the grid drive be removed for any reason, the contacts open and the B+ potential is reduced. This prevents damage to the electron tubes which could be caused by excessive cathode-plate current flow.

1-9. EXCITER R-F SECTION. Electron tube V-201 functions as a crystal oscillator and delivers a signal to V-203. Electron tube V-202 is placed across the tank circuit and functions as a reactance modulator to phase modulate the signal from V-201. Modulation signals from the deviation control section are impressed upon the cathode of V-202. The output from V-201 is successively multiplied in frequency by each of the stages containing electron tubes V-203, V-204, V-205, V-206, V-207 and V-208. The output from V-208, at a frequency of approximately 150

megacycles, is applied through J-202 and an internal coaxial cable, through J-302 to mixer stage V-303 in the output r-f section.

1-10, DEVIATION CONTROL SECTION. Either internal or external modulation signals are applied across DEVIATION potentiometer R-110. The output from R-110 is applied to the input grid of V-102 through internal deviation control R-164. The output from V-102 is applied to V-101 where it is amplified and applied to the cathode of reactance modulator V-202 in the exciter r-f section.

1-11. DEVIATION METERING SECTION. The internal or external modulation signals applied to the deviation control section are also applied to V-109 through internal deviation metering control R-145. The output from V-109 is applied to V-110 where it is amplified and applied to the DEVIATION meter through a rectifier and resistor bridge circuit.

1-12. A-F MODULATION SECTION. Electron tubes V-103, V-104, and V-105, and their associated circuit components are connected to form six a-f oscillators. Individual oscillators are placed in operation when the corresponding MODULATION CHANNEL switch is closed and a cathode-ground circuit is completed. Outputs from individual oscillators are controlled in amplitude by potentiometers R-115, R-120, R-125, R-130, R-135, and R-140. The outputs are applied to the first half of V-106 and are amplified. The second half of V-106 functions as a cathode follower and delivers its output to the DEVIATION potentiometer R-110 when the MODULATION switch is positioned to INT.

1-13. POWER SUPPLY SECTION. Primary 115 volts ac power is applied through receptacle J-105 and fuse F-101 to the POWER switch. When the POWER switch is OFF, power is applied to internal heaters which serve to maintain components

at a stable operating temperature. When the POWER switch is ON, power is applied to the primary of transformer T-101, which is provided with four secondary windings. One secondary winding supplies 28 volts ac to pin G of CODER POWER receptacle J-101. Another secondary winding supplies 6.3 volts ac power to generator electron tube heaters. A third winding supplies 5 volts ac to rectifier V-111. The center-tap is returned to ground through fuse F-102 and CARRIER switch S-102. Fuse F-102 functions to protect electron tube V-111 and associated parts should the B+ circuits become shorted. The high potential ac secondary winding is center-tapped and supplies the plates of V-111. When the CARRIER switch is ON, the center-tap ground return is completed and V-111 functions to rectify the high potential ac. The rectified B+ potential that appears on the heater of V-111 is filtered and then distributed to various generator electron tubes and to pin A of CODER POWER receptacle J-101. Electron tubes V-107 and V-108 together with their associated dropping resistors provide sources of regulated dc for the crystal oscillators, modulator and internal audio oscillators that would otherwise be affected by line voltage variations.

1-14. PHYSICAL DESCRIPTION OF SIGNAL GENERATOR BSG-7.

1-15. The Signal Generator BSG-7 is provided with a metal transit case which is to be employed as a protective housing during transportation of the unit. Components parts of the BSG-7 are housed within a rectangular metal case. The majority of components are mounted on a chassis assembly which is enclosed by the outer case. The outer case is provided with shockmounts and carrying handles. The chassis assembly is provided with a front panel which extends outside the case and mounts all of the operating controls and indicating devices. Refer to paragraph 2-1 for a

description of these components and their functions.

1-16. Access to chassis assembly components is obtained when the chassis is removed from the case housing. This can be accomplished by loosening the fourteen captive panel screws and sliding the case from the chassis. Chassis assembly components consist essentially of two r-f strips or subassemblies, six a-f oscillator circuits, a metering circuit, an attenuator mechanism, three internal heaters, and power supply components. All adjustment controls for the a-f oscillators, deviation metering, and frequency deviation circuits are accessible from the chassis underside. All adjustment controls for the r-f output and r-f exciter sections are accessible from the chassis topside.

1-17. The Signal Generator BSG-7 is housed within the transit case when it is to be transported or when it is to be stored for an extended period of time. The transit case is constructed of metal panels and is provided with carrying handles and a hinged metal cover. All accessories for the Signal Generator are secured to a metal lid within the transit case cover. Such accessories, which include a power cable CX-3422, three r-f cables CG-409A, two tee cable adapters type UG-274/U, a matching cable adapter type UG-201A/U, and an accessory antenna, are secured to the metal lid by means of clips. When desired, the accessory antenna can be removed from the lid and secured to the top of the signal generator case by means of 2 captive screws. The accessory antenna can then be connected to the R.F. OUTPUT receptacle J-103 by means of an accessory r-f cable, and will permit the Signal Generator to be used for ground check of receivers installed within drone aircraft, target aircraft, or guided missiles.

1-18. ELECTRICAL CHARACTERISTICS.

1-19. The applicable electrical characteristics of the Signal Generator are tabulated in Table 1-1.

TABLE 1-1. ELECTRICAL CHARACTERISTICS

SIGNAL GENERATOR BSG-7

OUTPUT CARRIER DATA	
Range	406 to 420 megacycles, in one megacycle increments.
Accuracy	Crystal controlled to 0.01 percent.
Amplitude	Continuously variable from five to 100,000 microvolts.
Impedance	52 ohms across R.F. OUTPUT receptacle J-103.
EXTERNAL MODULATION DATA	
Range	Any frequency between one and 80 kilocycles (external modulation introduced through EXT. A.F. IN receptacle J-102.)
Amplitude	An external modulation signal having an amplitude between 1.5 and 2 volts RMS is sufficient to frequency modulate the r-f carrier ±300 kilocycles.
Input Impedance	560 ohms across EXT. A.F. IN receptacle J-102.
INTERNAL MODULATION DATA	
Range	7500, 8460, 9540, 10760, 12140 and 13700 cycles per second.
Accuracy	±1.0 percent.
Amplitude	Variable to ±300 kilocycles.

TABLE 1-1. ELECTRICAL CHARACTERISTICS (cont)

SIGNAL GENERATOR BSG-7

POWER REQUIREMENTS

Input Voltage	115 volts ac, ±10 percent.
Input Frequency	50 to 1000 cycles per second.
Power Consumption	200 watts

1-20. ELECTRON TUBE, FUSE, AND INDICATOR LAMP COMPLEMENT.

1-21. The total number and types of electron tubes, fuses, and indicator lamps required for the operation of the Signal Generator BSG-7 are tabulated in Table 1-2.

TABLE 1-2. QUANTITY AND TYPES OF ELECTRON TUBES, FUSES AND INDICATOR LAMPS REQUIRED

Electron Tubes		Fuses		Indicator Lamps	
Type	Number	Type	Number	Type	Number
OA2	2	3AG3	1	GE-47	2
5R4WGY	1	3AG-1/2	1		
6AH6	3				
6AU6	3				
12AT7	10				
12AU7	6				

Figure 2-1. Signal Generator BSG-7, Front Panel View

SECTION II

OPERATION

2-1. FUNCTIONS OF OPERATING CONTROLS AND INDICATORS.

2-2. Front panel components (figure 2-1) and their functions are described as follows.

a. POWER Switch. - Applies and removes primary power to the internal power supply and heaters. In the ON position, primary power is applied to the internal power supply. In the OFF position, primary power is applied to the internal heaters.

b. CARRIER Switch. - Controls circuits of the internal power supply. In the ON position, B+ power is applied to all electron tubes of the generator and to pin A of CODER POWER receptacle J-101. In the OFF position, these power sources are removed.

c. POWER Lamp. - Illuminates when POWER switch is positioned to ON. This indicates that primary power is applied to the internal power supply, and is removed from the internal heaters.

d. CARRIER Lamp. - Illuminates when CARRIER switch is positioned to ON. This indicates that B+ power is applied to the Signal Generator electron tubes and that an r-f carrier should be available. Also, that power is available at the CODER POWER receptacle J-101.

e. FREQUENCY Knob. - Provides a means of selecting one of the 15 carrier frequencies. Each of the frequencies from 406 to 420 megacycles, in one megacycle increments, is inscribed on the FREQUENCY knob rim.

f. MODULATION Switch. - Provides a means of selecting either internal or external modulation. When positioned to EXT., the Signal Generator can be

modulated by external signals introduced through the EXT. A.F. IN receptacle J-102. When positioned to INT., the Signal Generator can be modulated by the internal oscillators as selected by the appropriate MODULATION CHANNEL switch.

g. EXT. A.F. IN Receptacle. - Provides a means of introducing external modulation signals to the Signal Generator.

h. MODULATION CHANNEL Switches. - These six switches provide a means of selecting the desired internal modulation frequency or frequencies. When the corresponding MODULATION CHANNEL switch is moved to the up position, the BSG-7 will be internally frequency modulated by the indicated frequency. The MODULATION switch must be positioned to INT. to obtain such internal modulation.

i. DEVIATION Knob and DEVIATION Meter. - The DEVIATION knob provides a means of controlling the frequency deviation of the r-f carrier when either internal or external modulation is employed. The amount of frequency deviation is indicated by the DEVIATION meter. The DEVIATION meter is calibrated in ±50 kilocycle increments, and is provided with a red ±300 KC index mark.

j. OUTPUT TUNING Knob. - Provides a means for tuning the final tripler after selection of the desired carrier frequency. The OUTPUT TUNING knob is tuned for a peak indication on the R.F. OUTPUT meter.

k. R.F. OUTPUT Meter. - Provides a means of monitoring the r-f output of the Signal Generator. The R.F. OUTPUT meter is used in conjunction with the OUTPUT TUNING knob when tuning the final tripler, and with the Carrier Output Dial when setting r-f carrier output level.

l. Carrier Output Dial. - Provides a means of setting the r-f carrier output level of the Signal Generator. The outer dial is used in conjunction with the R.F. OUTPUT

meter to set a 100,000 microvolt reference level. The inner dial is used to set the r-f carrier output level.

m. R.F. OUTPUT Receptacle J-103. - Provides for coupling the r-f carrier output of the Signal Generator to the accessory antenna or to the unit under test.

n. A.F. MONITOR Receptacle J-104. - Provides for monitoring of either internal or external modulation signals.

o. CODER POWER Receptacle J-101. - Provides a means of connecting the internal B+ and electron tube heater sources of the Signal Generator to a coder, external modulator or other equipment.

p. SPARE and 3 AMP Fuse Holders. - One 3 ampere fuse, F-101, is housed within the 3 AMP holder. A spare fuse is provided in the SPARE holder. Fuse F-101 protects the primary power input circuits of the Signal Generator.

q. Power Receptacle J-105. - Provides for connection to a source of 115 volts ac, 50 to 1000 cycle power. Receptacle J-105 is accessible from the back of the Signal Generator case and is located at the lower corner.

2-3. OPERATIONAL PRECAUTIONS.

2-4. Operation of the Signal Generator is not complex and does not merit detailed operational precautions. However, the operator must remember that placing the POWER switch in the OFF position does not remove primary power from the Signal Generator. (In the OFF position of the POWER switch, primary power is applied to the internal heaters.) Under emergency conditions such as internal shorts in the power circuits or similar occurrences, the Signal Generator must be secured by removing the power cable from receptacle J-105 or from the primary power source.

2-5. OPERATION OF THE SIGNAL GENERATOR BSG-7.

2-6. SEQUENCE OF OPERATION. The subsequent paragraphs describe all operational procedures for the Signal Generator. Due to design characteristics, operation of the subject unit is not complex. However, the using personnel should carefully study the following instructions to insure optimum performance and to minimize the possibility of erroneous readings due to misuse. Although these instructions are applicable to all conditions of operation and are in the normal sequence of operation, the using personnel need employ only those procedures which are required for their particular tests.

2-7. SETTING UP EQUIPMENT FOR OPERATION. Proceed as follows to set up the unit for use. (See figures 1-1 and 2-1.)

a. Remove the Signal Generator and accessories from the transit case.

b. Place the Signal Generator on a suitable work bench or at the desired installation location. Employ the shock mount provisions located on the unit bottom as necessary.

c. If the accessory antenna is to be employed, mount the antenna on top of the signal generator case by means of the two captive screws, and connect it to the R.F. OUTPUT receptacle on the Signal Generator front panel. The accessory r-f cables and cable adapters can be employed as necessary to make this attachment. Connect an accessory r-f cable, CG-409A/U, to the antenna. Connect an accessory cable adapter UG-201A/U to the opposite end of the r-f cable. The r-f cable can then be connected to the R.F. OUTPUT receptacle J-103.

2-8. STARTING EQUIPMENT. Proceed as follows to start the Signal Generator. (See figure 2-1.)

a. Connect the accessory power cable, CX-3422/U, to receptacle J-105 and to a

source of 115 volts ac, 50 to 1000 cycle power. The receptacle J-105 is accessible from the back of the signal generator case and is located at the lower corner.

NOTE

Once the power cable is connected, the internal standby heaters of the Signal Generator will become energized and will remain energized until the POWER switch is positioned to ON. This will maintain internal components at a stable operating temperature during periods of non-use. It is recommended that the power cable be left connected if intermittent operation of the Signal Generator is anticipated.

b. Position the POWER switch to ON and note that the POWER lamp illuminates. This indicates that all electron tube heaters have been energized and that 28 volts ac power is available at pin G of CODER POWER receptacle J-101. It is recommended that the electron tube heaters be allowed to warmup for a period of three minutes.

c. After a suitable warmup period, position the CARRIER switch to ON and note that the CARRIER lamp illuminates. This indicates that B+ power is available to all electron tubes and at pin A of CODER POWER receptacle J-101. The Signal Generator is now ready for operation.

2-9. OPERATION TO OBTAIN UNMODULATED R-F CARRIER OUTPUT. Proceed as follows to obtain an unmodulated r-f carrier output.

a. Rotate the FREQUENCY knob until the desired r-f carrier frequency inscribed on the knob rim is directly below the MC index marker.

b. Rotate the inner carrier output dial clockwise until an indication is obtained on the RF OUTPUT meter.

c. Rotate the OUTPUT TUNING knob as necessary to obtain a peak indication on the RF OUTPUT meter.

d. Rotate the inner carrier output dial until the RF OUTPUT meter needle is aligned with the red SET 100K index mark.

e. Adjust the fiducial ring of the carrier output dial until its index mark is aligned with the inner carrier output dial 100K (100,000 microvolts) mark. The output level of the Signal Generator can now be adjusted by means of the inner carrier output dial. Rotate the inner dial until the desired output level (in microvolts) inscribed on the inner dial rim is exactly aligned with the fiducial ring index mark.

NOTE

The r-f level indication will be as indicated on the inner dial only when the load connected to R.F. OUTPUT receptacle J-103 is 52 ohms resistive at the output frequency.

f. An unmodulated r-f carrier output should now be available at R.F. OUTPUT receptacle J-103. To frequency modulate this carrier at any one of the six internal modulation frequencies, follow the instructions of paragraph 2-10. To modulate the carrier at other frequencies obtained from an external source, follow the instructions of paragraph 2-11.

2-10. OPERATION TO OBTAIN INTERNAL FREQUENCY MODULATION. Proceed as follows to obtain internal modulation at any one of the six preset a-f frequencies.

a. Accomplish all procedures outlined in paragraphs 2-7, 2-8, and 2-9.

b. Position the MODULATION switch to INT.

c. Position the appropriate MODULATION CHANNEL switch up to select the desired modulation frequency.

d. Rotate the **DEVIATION** knob clockwise until the desired amount of frequency deviation is obtained as indicated by the DEVIATION meter. The DEVIATION meter is calibrated in ±50 kilocycle increments. However, the normal amount of deviation is ±300 kilocycles. This point is indicated on the DEVIATION meter by a red ±300 KC index mark.

e. An r-f carrier output modulated at the selected frequency should now be available at R.F. OUTPUT receptacle J-103. Any one of the additional five internal modulation frequencies can be selected by positioning the corresponding **MODULATION CHANNEL** switch up. Several of the internal modulation frequencies or audio channels can be used simultaneously. In the case of multiple channel operation, the deviation level is adjusted to ±300 kilocycles in the same manner as that for a single modulation frequency.

2-11. **OPERATION TO OBTAIN EXTERNAL FREQUENCY MODULATION.** Proceed as follows to obtain external modulation of the r-f carrier. (See figure 2-1.)

a. Accomplish all procedures outlined in paragraphs 2-7, 2-8, and 2-9.

b. Position the **MODULATION** switch to EXT.

c. Connect the output of the external modulation source to the EXT. A.F. IN receptacle J-102. Monitoring of the external source may be accomplished by connecting the monitoring device to A.F. MONITOR receptacle J-104.

d. Adjust the output of the external modulation source to the desired frequency. External modulation can be accomplished at any frequency between the limits of 1 to 80 kilocycles.

e. Adjust output of the external modulation source to a value between 1.5 and ? volts rms.

f. Rotate the DEVIATION knob clockwise until the desired amount of frequency deviation is obtained as indicated by the DEVIATION meter. Under normal conditions, adjust the DEVIATION knob until the DEVIATION meter needle is aligned with the red ±300 KC index mark.

g. An r-f carrier output modulated by the external source should now be available at the R.F. OUTPUT receptacle J-103.

NOTE

The A.F. MONITOR receptacle J-104 can be used as desired with either internal or external modulation. Also, the CODER POWER receptacle J-101 provides a means of using a coder such as the Audio Coder BCC-4 with the Signal Generator. To use such a coder, connect a cable between the CODER POWER receptacle J-101 and the corresponding receptacle on the coder, connect a second cable between the EXT. A.F. IN receptacle J-102 and the audio output receptacle of the coder, and follow the procedures of paragraphs 2-7, 2-8, 2-9, and 2-11.

2-12. SECURING THE SIGNAL GENERATOR. Proceed as follows to secure the Signal Generator.

a. Position the CARRIER switch to OFF and note that the CARRIER lamp is extinguished.

b. Position the POWER switch to OFF and note that the POWER lamp is extinguished. If standby operation is desired, leave the POWER switch ON and the CARRIER switch OFF.

c. If the Signal Generator is to be secured for an extended period of time, remove

the power cable from receptacle J-105. If intermittent operation is anticipated, leave the power cable in place. With this configuration, the internal heaters will remain energized. In tropical climates the internal heaters should be energized when the equipment is secured for extended periods of time, or the Signal Generator should be replaced in the transit case and the transit case cover secured.

CAUTION

Under emergency conditions, such as internal shorts in the power circuits or similar occurrences, the equipment must be secured by removing the power cable from receptacle J-105 or the primary power source.

SECTION III

TEST EQUIPMENT

3-1. RECOMMENDED TEST EQUIPMENT.

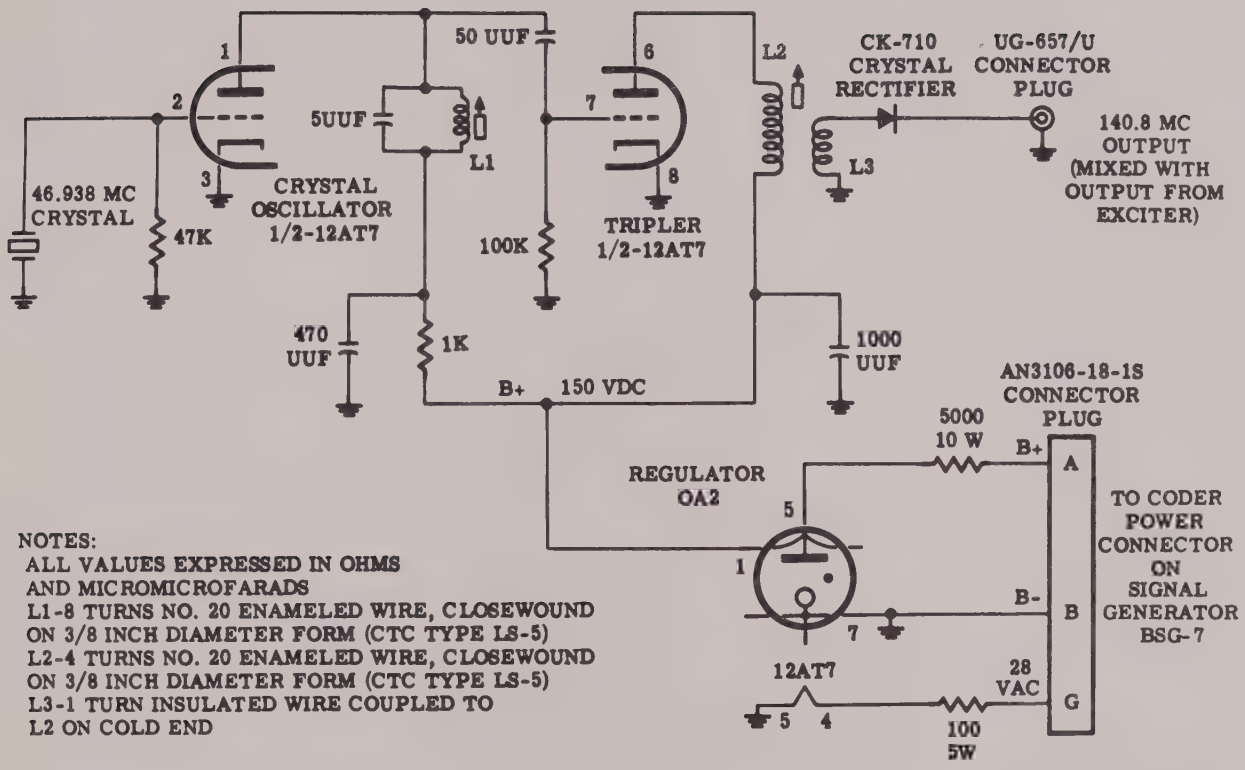
3-2. Test equipment necessary for performing maintenance of the BSG-7 as described in Section IV is tabulated in Table 3-1.

3-3. SPECIAL TEST OSCILLATOR.

3-4. Figure 3-1 illustrates a special test oscillator which is employed during alignment of the Signal Generator r-f output chassis. The output of this oscillator is mixed with the output of the r-f output chassis and the resultant difference frequency output is fed to the BC-779 test receiver; thus adapting the lower frequency receiver to operate on the high frequency output of the r-f output section.

TABLE 3-1. TEST EQUIPMENT RECOMMENDED FOR SERVICE AND OVERHAUL

Equipment	Type
A-f Oscillator	TS-382A/U or Hewlett-Packard Model 200C
Vacuum Tube Voltmeter	TS-375/U or Hewlett-Packard Model 410B
Frequency Meter	TS-323/UR or Gertsch Model FM-3
Frequency Meter	AN/USM-26 or Berkeley Model 554
Receiver	AN/URM-28
Panoramic Adapter	Panoramic Radio Products Model SA-3, Type T-3000
Special Test Oscillator	(See figure 3-1 for schematic wiring diagram)
Receiver	BC-779
Tube Tester	TV-3C/U or Hickok Model 540



NOTES:
ALL VALUES EXPRESSED IN OHMS
AND MICROMICROFARADS
L1-8 TURNS NO. 20 ENAMELED WIRE, CLOSEWOUND
ON 3/8 INCH DIAMETER FORM (CTC TYPE LS-5)
L2-4 TURNS NO. 20 ENAMELED WIRE, CLOSEWOUND
ON 3/8 INCH DIAMETER FORM (CTC TYPE LS-5)
L3-1 TURN INSULATED WIRE COUPLED TO
L2 ON COLD END

Figure 3-1. Suggested Test Oscillator, Schematic Wiring Diagram

TABLE 3-1. TEST EQUIPMENT RECOMMENDED FOR SERVICE AND OVERHAUL (cont)

Equipment	Type
Multimeter	TS-352/U or Simpson Model 260
Light Bulb	GE No. 49

SECTION IV

MAINTENANCE

4-1. INSPECTIONS.

4-2. PRELIMINARY INSPECTION. Inspect the Signal Generator as follows:

a. Check the transit case for obvious physical damage, wear, or deterioration of case and shockmounts. Check the case lid seal for evidence of damage.

b. Check the case housing and panel for signs of physical damage. Examine meters, switches, and other controls for evidence of damage.

c. Remove the accessory cable plugs from the receptacles of the Signal Generator. Check plugs and receptacles for signs of damage such as bent or broken pins, stripped or crossed threads, and for accumulation of dirt, moisture, oxidation, or dust. Check plug and receptacle pins and contacts for corrosion.

d. Check all accessory cables for proper continuity. Check for shorts between wires and from wires to ground or shielding.

e. Check the accessory cables for evidence of damage, corrosion, broken insulation, or frayed coverings.

4-3. DETAILED INSPECTION.

a. Repeat the preliminary inspection procedures.

b. Remove the Signal Generator from its case housing by loosening the fourteen captive panel screws and sliding the panel and chassis assembly from the case housing.

c. Check all plug-in parts for evidence of broken or bent pins. Check plug-in part pins and sockets for corrosion, loose connections, or evidence of excessive wear.

d. Remove and test all electron tubes on a suitable tube tester such as is tabulated

in Table 3-1. Substandard electron tubes must be discarded and replaced with tubes known to be in good operating condition. Make certain to replace all electron tubes in their proper sockets, and to replace tube shields.

e. Make a thorough inspection of the Signal Generator wiring. Check for frayed, damaged, loose, or burned wires or terminals.

f. Check resistors for loose wires and evidence of burning or cracking.

g. Check capacitors for loose wires, leakage of insulating compound, or physical damage.

h. Check the tightness of all mounting hardware.

i. Replace the Signal Generator in its case housing.

4-4. BENCH TEST OF THE SIGNAL GENERATOR BSG-7.

4-5. CHECK OF R-F OUTPUT FREQUENCIES.

a. Remove the Signal Generator and accessories from the transit case.

b. Place the Signal Generator on a suitable workbench, employing the shockmount provisions located on the case bottom as necessary.

c. Connect the accessory power cable to receptacle J-105 and to a source of 115 volts ac, 50 to 1000 cycle power. Receptacle J-105 is accessible from the back of the Signal Generator and is located at the lower corner.

d. Position the POWER switch to ON and note that the POWER pilot lamp illuminates. This indicates that all electron tube heaters have been energized and that 28 volts ac power is available at pin G of CODER POWER receptacle J-101.

e. After a warmup period of approximately five minutes, position the CARRIER switch to ON and note that the CARRIER lamp illuminates. This indicates that B+ power is available to all electron tubes and at pin A of CODER POWER receptacle J-101.

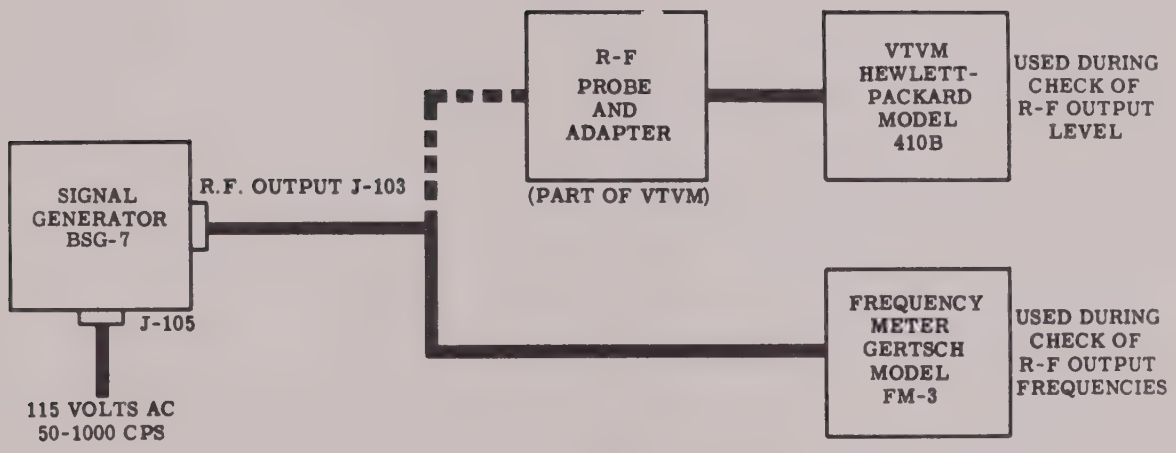

SIGNAL GENERATOR BSG-7
R.F. OUTPUT J-103
J-105
115 VOLTS AC 50-1000 CPS
R-F PROBE AND ADAPTER
(PART OF VTVM)
VTVM HEWLETT-PACKARD MODEL 410B
USED DURING CHECK OF R-F OUTPUT LEVEL
FREQUENCY METER GERTSCH MODEL FM-3
USED DURING CHECK OF R-F OUTPUT FREQUENCIES

Figure 4-1. Bench Test Diagram for Check of R-f Frequencies and Output Levels

f. Rotate the FREQUENCY knob until 406 is directly below the MC index marker.

g. Rotate the inner carrier output dial clockwise until an indication is obtained on the RF OUTPUT meter.

h. Rotate the OUTPUT TUNING knob as necessary to obtain a peak indication on the RF OUTPUT meter.

i. Rotate the inner carrier output dial until the RF OUTPUT meter needle is aligned with the red SET 100K index mark.

j. Adjust the fiducial ring of the carrier output dial until its index mark is aligned with the inner carrier output dial 100K (100,000 microvolts) mark.

k. Connect a frequency meter to the R.F. OUTPUT receptacle J-103 as shown in figure 4-1. Rotate the inner carrier output dial as necessary to obtain an indication on the frequency meter. Operate frequency meter controls as necessary to measure frequency of the r-f output from J-103.

l. With the FREQUENCY knob adjusted to 406 megacycles, the indicated frequency must be within the limits of 405.9594 to 406.0406 megacycles.

m. Repeat steps f through l of this paragraph, checking each frequency in turn from 406 to 420 megacycles. The high limit and low limit tolerances for each of the 15 r-f frequencies are tabulated in Table 4-1. The frequencies indicated on the frequency meter must be within the specified tolerances.

TABLE 4-1. R-F OUTPUT FREQUENCY TOLERANCE CHART

R-F Frequency (Megacycles)	Low Limit (Megacycles)	High Limit (Megacycles)
406	405.9594	406.0406
407	406.9593	407.0407
408	407.9592	408.0408
409	408.9591	409.0409
410	409.9590	410.0410
411	410.9589	411.0411
412	411.9588	412.0412
413	412.9587	413.0413
414	413.9586	414.0414
415	414.9585	415.0415
416	415.9584	416.0416
417	416.9583	417.0417
418	417.9582	418.0418
419	418.9581	419.0419
420	419.9580	420.0420

4-6. CHECK OF R-F OUTPUT LEVEL.

a. Repeat steps a through j of paragraph 4-5.

b. Connect a VTVM to the R.F. OUTPUT receptacle J-103 as shown in figure 4-1. Rotate the inner carrier output dial to 100K. Operate the VTVM controls as necessary to measure the r-f output level from J-103.

c. With the inner carrier output dial positioned to 100K, the indicated level must be 100,000 microvolts ±10 percent.

4-7. CHECK OF INTERNAL MODULATION OSCILLATOR FREQUENCIES.

a. Repeat steps a through e of paragraph 4-5.

b. Connect an AN/USM-26 frequency meter to the A.F. MONITOR receptacle J-104 as shown in figure 4-2.

c. Position the MODULATION switch to INT.

d. Position MODULATION CHANNEL switch No. 1 upward. Operate the frequency meter controls as necessary to measure frequency of the a-f output from J-104.

e. With the MODULATION CHANNEL switch No. 1 positioned upward, the indicated frequency must be within the limits of 7425 to 7575 cycles per second.

f. In turn, position MODULATION CHANNEL switch numbers 2, 3, 4, 5, and 6 upward. Operate the frequency meter controls as necessary to measure frequency of the a-f output from J-104. The high limit and low limit tolerances for each of the six internal modulation oscillator frequencies are tabulated in Table 4-2. The frequencies indicated on the frequency meter must be within the specified tolerances.

TABLE 4-2. INTERNAL MODULATION OSCILLATOR FREQUENCY TOLERANCE CHART

Modulation Channel	Oscillator Frequency (Cps)	Low Limit (Cps)	High Limit (Cps)
1	7500	7425	7575
2	8460	8375	8545
3	9540	9445	9635
4	10760	10652	10868
5	12140	12019	12261
6	13700	13563	13837

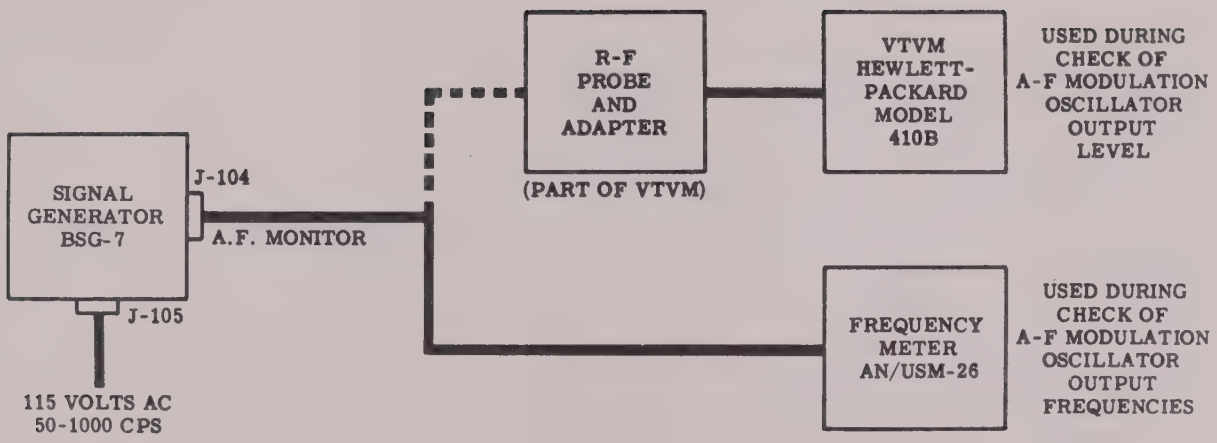


Figure 4-2. Bench Test Diagram for Check of Internal Modulation Oscillator Frequencies and Output Levels

4-8. CHECK OF INTERNAL MODULATION OSCILLATOR OUTPUT LEVELS.

a. Repeat steps a through e of paragraph 4-5.

b. Connect a VTVM to the A.F. MONITOR receptacle J-104 as shown in figure 4-2.

c. Position the MODULATION switch to INT.

d. Position MODULATION CHANNEL switch No. 1 upward. Operate the VTVM controls as necessary to measure amplitude of the a-f output from J-104.

e. With MODULATION CHANNEL switch No. 1 positioned upward, the amplitude must be 0.84 volts ac ±5%.

f. In turn, position MODULATION CHANNEL switch numbers 2, 3, 4, 5, and 6 upward. Observe the a-f voltage levels as indicated on the VTVM for each of the frequencies. The indications must be 0.84 volts ac ±5% in each case.

4-9. CHECK OF DEVIATION METER CIRCUIT INPUT LEVEL.

a. Loosen the 14 captive panel screws and remove the signal generator case. Place the Signal Generator on its side so that test point TP-101 is accessible. Test point TP-101 is at the junction of DEVIATION potentiometer R-110 wiper arm, capacitor C-137 and capacitor C-131. (See figure 4-9.)

b. Repeat steps a through e of paragraph 4-5.

c. Connect a VTVM to test point TP-101 and ground.

d. Position the MODULATION switch to INT.

e. Position MODULATION CHANNEL switch No. 1 upward.

f. Adjust the DEVIATION knob until the DEVIATION meter needle is aligned exactly with the ±300KC index mark.

g. The VTVM indication at test point TP-101 must be 1.1 volts ac.

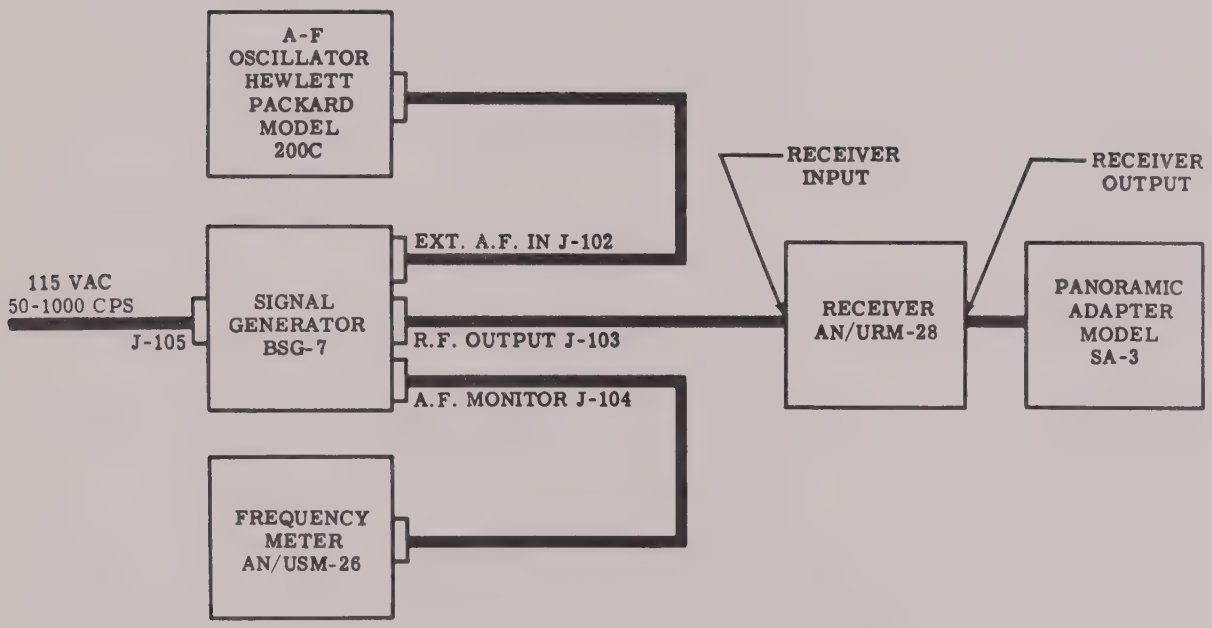


Figure 4-3. Bench Test Diagram for Check of Modulation Linearity at Frequencies Above 7500 cps

4-10. CHECK OF FREQUENCY DEVIATION LEVEL AND PHASE MODULATION LINEARITY.

a. Repeat steps a through j of paragraph 4-5.

b. Connect an a-f oscillator to the EXT. A.F. IN receptacle J-102. Connect an AN/USM-26 frequency meter to A.F. MONITOR receptacle J-104. Position the MODULATION switch to EXT. Connect the R.F. OUTPUT receptacle J-103 to the input of a test receiver. Connect the receiver output to a panoramic adapter. Connect all test equipment as shown in figure 4-3. Use the accessory cables as necessary.

c. Tune the receiver to the r-f carrier output frequency of the generator as selected by the FREQUENCY knob. Adjust controls on the receiver and panoramic adapter as necessary until a single unmodulated signal is observed at the center of the panoramic adapter screen.

d. Rotate the DEVIATION knob full counterclockwise. Position the MODULATION switch to EXT.

e. Operate controls on the a-f oscillator connected to J-102 until an indication of 7500 cps is obtained on the frequency meter connected to J-104.

f. Slowly rotate the DEVIATION knob clockwise and observe the r-f carrier signal on the panoramic adapter screen. Count the number of carrier disappearances as the DEVIATION knob is rotated clockwise. With 7500 cps modulation, the carrier should disappear 13 times for ±300 kilocycle deviation. Also, the DEVIATION meter needle should be at the red ±300 KC index mark to indicate ±300 kilocycle deviation.

g. Repeat steps d, e and f of this paragraph using each of the seven external

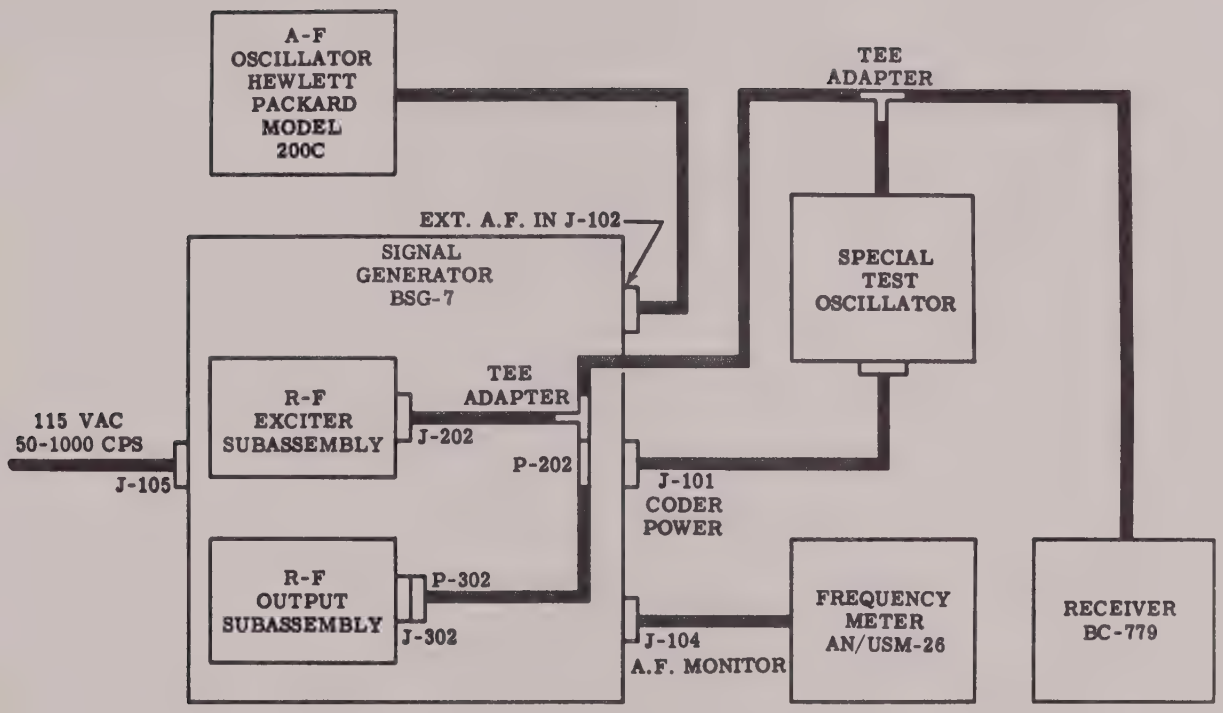


Figure 4-4. Bench Test Diagram for Check of Modulation Linearity at Frequencies Below 7500 cps

modulation frequencies specified in Table 4-3. The correct number of carrier disappearances must be obtained for each of the modulation frequencies as specified in Table 4-3.

h. Remove the connection between the R.F. OUTPUT receptacle J-103 and the receiver input. Temporarily position the CARRIER switch to OFF. Remove the coaxial cable plug P-202 from receptacle J-202 on the r-f exciter subassembly. Connect an accessory tee adapter to J-202. Re-connect P-202 to one side of the tee adapter. Connect the opposite side of the tee adapter to the test oscillator tabulated in Table 3-1. This connection should also be made with a tee adapter. Connect the opposite side of the test oscillator tee adapter to the test receiver. Connect all test equipment as shown in figure 4-4. Use the accessory cables and adapters as necessary. Position the CARRIER switch to ON.

i. Tune the test receiver to the difference frequency of the r-f exciter and the test oscillator. This frequency should be approximately 9.8 megacycles. Advance the receiver crystal selector to position 4 in order to increase selectivity of the receiver.

j. Rotate the DEVIATION knob full counterclockwise. Position the MODULATION switch to EXT.

k. Operate controls on the a-f oscillator connected to J-102 until an indication of 6039 cps is obtained on the frequency meter connected to J-104.

l. Slowly rotate the DEVIATION knob clockwise and observe the r-f carrier signal on the S meter of the test receiver. Count the number of carrier disappearances as the DEVIATION knob is rotated clockwise. With 6039 cps modulation, the carrier should disappear two times for ±300 kilocycle deviation. Also, the DEVIATION

meter needle should be at the red ±300KC index mark to indicate ±300 kilocycle deviation.

m. Repeat steps j, k and l of this paragraph using each of the five external modulation frequencies specified in Table 4-4. The correct number of carrier disappearances must be obtained for each of the modulation frequencies as specified in Table 4-4.

TABLE 4-3. DEVIATION LINEARITY CHART FOR FREQUENCIES ABOVE 7500 CPS

Modulation Frequency (Cps)	Carrier Disappearances (Panoramic Adapter)
7500	13
8900	11
10910	9
16601	6
34666	3
54348	2
78288	1.5

TABLE 4-4. DEVIATION LINEARITY CHART FOR FREQUENCIES BELOW 7500 CPS

Modulation Frequency (Cps)	Carrier Disappearances (Receiver S Meter)
987	11
1369	8
2232	5
3852	3
6039	2

4-11. TROUBLE SHOOTING.

4-12. GENERAL. Table 4-5 outlines detailed procedures for localization of component malfunction or maladjustment to a specific subassembly, circuit, or part of the Signal Generator. The information contained in Table 4-5 is predicated on the assumption that the subject unit has been removed to suitable bench test facilities, that all test equipment tabulated in Table 3-1 is available, and that the subject unit is being subjected to the test procedures outlined in paragraphs 4-5 through 4-10.

4-13. PRELIMINARY CHECKS. In view of the relative complexity of the Signal Generator certain preliminary checks are included, which may eliminate unnecessary servicing operations before proceeding with the trouble shooting procedures of Table 4-5. Particular types of troubles may be located rapidly by performing the preliminary checks prior to systematic checking of individual circuits. Proceed as follows if the subject unit fails to fulfill the bench test requirements of paragraphs 4-5 through 4-10.

a. If the POWER pilot lamp fails to illuminate when the POWER switch is positioned to ON, check for defective fuse F-101.

b. If no r-f output is obtained from J-103, as checked in paragraph 4-5, check for r-f output from J-202 on the r-f exciter subassembly. This can be accomplished as follows. Position the CARRIER switch to OFF. Remove P-202 from J-202. Connect an accessory tee adapter to J-202. Connect P-202 to the tee adapter. Connect a VTVM or No. 49 light bulb to the opposite end of the tee adapter. Position the CARRIER switch to ON. Check for presence of r-f as indicated on the VTVM or light bulb. If r-f is indicated at J-202 but not at J-103, the trouble can be localized to the r-f output subassembly. If no r-f is indicated at J-202, the trouble is probably in the r-f exciter subassembly.

c. If r-f output is obtained from J-103 but the frequencies are not within tolerance as checked in paragraph 4-5, the trouble can be isolated to one of two major causes. If all frequencies are out of tolerance or nearly out of tolerance, the most likely cause of trouble is misalignment of the r-f subassemblies. In such an event, refer to paragraphs 4-20 and 4-21 for complete alignment procedures of both subassemblies. If only one or two frequencies are out of tolerance, the trouble may be caused by a defective crystal Y-301 through Y-315. In such an event, the corresponding crystals can be replaced. However, after the replacement of one crystal, it will be necessary to recheck all frequencies as outlined in paragraph 4-5 to insure proper operation. This action may indicate the need for further alignment of the r-f subassemblies.

d. If r-f output is obtained from J-103 but the output level is not correct as checked in paragraph 4-6, the r-f subassemblies may be malfunctioning or the R.F. OUTPUT meter M-102 may be improperly adjusted. If 100,000 microvolts can not be obtained with the final tripler tuned for peak, the trouble is in the r-f subassemblies. If adequate r-f output is obtained but the M-102 indication does not correspond to the test VTVM indication, M-102 is not properly adjusted.

e. It is recommended that a systematic trouble shooting analysis of the equipment be performed as outlined in Table 4-5 once trouble has been localized to either of the r-f subassemblies. Table 4-5 also provides for localization of trouble within the a-f modulation section, the deviation metering section, the deviation control section circuit and the power supply section.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART

R-F OUTPUT SUBASSEMBLY CHECK

SYMPTOM	PROBABLE CAUSE	REMEDY
R-f output not within frequency tolerances specified in Table 4-1. R-f output amplitude less than 100,000 microvolts.	R-f output or r-f exciter assembly improperly aligned.	Refer to paragraph 4-13. If alignment is indicated, refer to the alignment procedures of paragraphs 4-20 and 4-21. If defective r-f output subassembly is indicated proceed with the following steps of this section of the table. If defective r-f subassembly is indicated follow the steps of the next section: R-F EXCITER SUBASSEMBLY CHECK.
When VTVM connected to TP-301 (see figure 5-1) voltages obtained for each position of FREQUENCY knob not within tolerances of -0.7 to -1.8 volts.	V-301 defective.	Check V-301 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
	Defective crystals Y-301 through Y-315.	Check crystals by substitution.
When VTVM connected to TP-302 (see figure 5-1) voltages obtained for each position of FREQUENCY knob not within tolerance of -0.5 to -1.0 volts.	V-302 defective.	Check V-302 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figure 5-2 and 5-3.
When VTVM connected to TP-303 (see figure 5-1) voltages obtained for each position of FREQUENCY knob not within tolerance of -1.0 to -2.0 volts dc.	V-303 defective.	Check V-303 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figure 5-2 and 5-3.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

SYMPTOM	PROBABLE CAUSE	REMEDY
R-F OUTPUT SUBASSEMBLY CHECK		
When VTVM connected to TP-304 (see figure 5-1) voltages obtained for each position of FREQUENCY knob not within tolerance of -4.5 to -5.5 volts dc.	V-304 defective.	Check V-304 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figure 5-2 and 5-3.
When VTVM connected to TP-305 (see figure 5-1) voltages obtained for each position of FREQUENCY knob not approximately -2.0 volts dc.	V-305 defective.	Check V-305 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
R-F EXCITER SUBASSEMBLY CHECK		
When VTVM connected to TP-201 (see figure 5-1), voltage obtained not within tolerance of -2.0 to -4.0 volts dc.	Tube V-201, V-202, V-203 or V-204 defective.	Check V-201, V-202, V-203, or V-204 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
When VTVM connected to TP-202 (see figure 5-1) voltage obtained not within tolerances of -3.0 to -5.0 volts dc.	V-205 defective.	Check V-205 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
When VTVM connected to TP-203 voltage obtained not within tolerance of -3.0 to -4.0 volts dc.	V-206 defective.	Check V-206 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

R-F EXCITER SUBASSEMBLY CHECK

SYMPTOM	PROBABLE CAUSE	REMEDY
When VTVM connected to TP-204 voltage obtained not within tolerance of -3.0 to -4.5 volts dc.	V-207 defective.	Check V-207 by substitution.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
A-F MODULATION SECTION CHECK		
Under test conditions of paragraph 4-7, a-f output not within frequency tolerance as specified in Table 4-2. A-f amplitude not 0.84 volts ac as specified in paragraph 4-8.	V-106 defective.	Check V-106 by substitution.
	Associated circuit components defective.	Check V-106 pin resistances and voltages as in figures 5-2 and 5-3. If one or more signals absent, proceed with following test procedures. If one or more frequencies not within tolerance or are not of correct amplitude refer to alignment procedures of paragraphs 4-22 and 4-23.
In the succeeding steps of this section of the trouble shooting chart the VTVM is connected between pin 2 of V-106 and ground.		
When S-104 closed, a-f output of 0.5 volts ac cannot be obtained with any setting of R-140.	V-103 defective.	Check V-103 by substitution or on tube tester.
	C-121 and/or R-142 defective.	Check components by substitution.
	Other associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

A-F MODULATION SECTION CHECK

SYMPTOM	PROBABLE CAUSE	REMEDY
When S-105 closed, a-f output of 0.5 volts ac cannot be obtained with any setting of R-135.	C-118 and/or R-137 defective.	Check components by substitution.
When S-106 closed, a-f output of 0.5 volts ac cannot be obtained with any setting of R-130	V-104 defective.	Check V-104 by substitution or on tube tester.
	C-115 and/or R-132 defective.	Check components by substitution.
	Other associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
When S-107 closed, a-f output of 0.5 volts ac cannot be obtained with any setting of R-125.	C-112 and/or R-127 defective.	Check components by substitution.
When S-108 closed, a-f output of 0.5 volts ac cannot be obtained with any setting of R-120.	V-105 defective.	Check V-105 by substitution or on tube tester.
	C-109 and/or R-122 defective.	Check components by substitution.
	Other associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
When S-109 closed, a-f output of 0.5 volts a-c cannot be obtained with any setting of R-115.	C-106 and/or R-117 defective.	Check components by substitution.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

DEVIATION METERING SECTION CHECK

SYMPTOM	PROBABLE CAUSE	REMEDY
(See test conditions of paragraph 4-9.)		
A ±300 kc deviation indication is not obtained on M-101 with 1.1 volts ac on TP-101 (see figure 5-1).	If indication absent or abnormal at TP-101, R-109 and/or R-110 defective.	Check components by substitution.
	If indication abnormal at M-101, but correct at TP-101, deviation metering circuit improperly aligned.	Refer to alignment procedures of paragraph 4-24.
	If indication absent at M-101, the following causes are probable.	
	V-109 and/or V-110 defective.	Check tubes by substitution or on tube tester.
	Associated circuit components defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
	C-137, R-145, C-128, C-129, and/or C-130 defective.	Check components by substitution.
DEVIATION CONTROL SECTION CHECK		
(VTVM connected to pin B of J-201, see figure 5-1.)		

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

SYMPTOM	PROBABLE CAUSE	REMEDY
DEVIATION CONTROL SECTION CHECK		
Cannot obtain a-f voltage of 0 to 5.0 volts ac on VTVM at any setting of R-164 with 1.1 volts ac on TP-101.	If indication absent V-101 and/or V-102 defective.	Check tubes by substitution or on tube tester.
	Associated circuit component defective.	Check tube pin voltages and resistances as in figures 5-2 and 5-3.
	C-131, C-134, and/or C-135 open.	Check components by substitution.
	If correct voltage range unobtainable R-164 improperly adjusted.	Refer to alignment procedures of paragraph 4-24.
POWER SUPPLY SECTION CHECK		
When VTVM connected to output side of L-102 (see figure 5-1), voltage indication not +250 volts dc.	One of following components defective: T-101, V-111, L-101, L-102, C-101, C-102, and/or C-103.	Check V-111 by substitution or on tube tester.
		Check V-111 tube pins for voltages and resistances as in figures 5-2 and 5-3.
		Check L-101 and L-102 for continuity and for shorts to ground.
		Check capacitors for shorts and opens.
When VTVM connected to pin 5 of V-108 (see figure 5-1), voltage indication not +150 volts dc.	V-108 defective.	Check V-108 by substitution or on tube tester.
	R-105 defective.	Check R-105 by substitution.

TABLE 4-5. SIGNAL GENERATOR BSG-7
TROUBLE SHOOTING CHART (cont)

POWER SUPPLY SECTION CHECK

SYMPTOM	PROBABLE CAUSE	REMEDY
When VTVM connected to pin 5 of V-107, voltage indication not +150 volts dc.	V-107 defective.	Check V-107 by substitution or on tube tester.
	R-106 defective.	Check R-106 by substitution.
When VTVM connected to pin G of J-101 (see figure 5-1), voltage indication not 28 volts ac.	T-101 winding defective.	Check for open winding or shorts to ground.
	Z-103 defective.	Check Z-103 for continuity and for shorts to ground.
When VTVM connected to pin A of J-101 (see figure 5-1), voltage indicated not +180 volts dc.	R-171 defective.	Check R-171 by substitution.
When VTVM connected across I-101 (see figure 5-1), voltage indicated not 6.3 volts ac.	T-101 winding defective.	Check for open winding or for shorts to ground.
	C-126 shorted.	Check C-126 by substitution.

4-14. DISASSEMBLY OF THE SIGNAL GENERATOR BSG-7.

4-15. GENERAL. In order to gain access to component parts of the r-f exciter chassis and the r-f output chassis for repair and alignment procedures, it is necessary to remove these two chassis from the main chassis assembly. Removal of the aforementioned chassis is included in the general disassembly procedures described in the subsequent paragraphs. Complete disassembly of the Signal Generator is not anticipated. Detailed instructions are included only where it is felt that the disassembly method may not be obvious.

NOTE

Do not disassemble the Signal Generator or its subassemblies beyond that point necessary to accomplish the necessary repairs, replacement of parts, or alignment procedures. Further disassembly is needless and could result in the misplacement of component parts.

4-16. DISASSEMBLY PROCEDURES. Disassemble the Signal Generator as follows:

a. Place the Signal Generator on a suitable work bench.

b. Loosen the 14 captive screws located on the front panel and slide the chassis from the case. If required, remove screws, nuts, and washers and separate the base from the shockmounts. If required, remove screws and washers, and separate the shockmounts from the case.

c. (See figure 4-7.) If it becomes necessary to remove meters M-101 and M-102, fuse holder XF-101, the panel light holders, capacitor C-136, connectors J-101, J-102, and J-104, or switches S-101 through S-109, proceed as follows. Tag all electrical leads prior to removal. This will insure proper re-connection upon replacement. Remove the corresponding attaching hardware and separate the items from panel.

d. (See figure 4-8.) Electron tubes V-101 through V-306 are protected by shields. These shields must be rotated counterclockwise and lifted to effect removal. The electron tubes should then be extracted by use of a miniature electron tube puller. Crystal Y-201 can be removed by simply pulling upward on the crystal holder. To remove transformer T-101, filter inductances L-101 and L-102, capacitors C-101 through C-104, or potentiometer R-170, follow the procedure outlined in step c of

this paragraph. To remove the r-f exciter chassis, remove connector P-202 from J-202, remove connector P-201 (see figure 4-9) from J-201, remove the six screws and washers which pass through the main chassis into the r-f exciter chassis bottom, and lift the r-f exciter chassis from the main chassis. To remove the r-f output chassis, remove connector P-302 from J-302, remove connector P-301 from J-301 on filter Z-301, remove P-303 from J-303, remove the six screws and washers which pass through the main chassis and r-f output chassis, remove the two screws and four washers which secure the gear train assembly (see figure 4-9), to the r-f output chassis, remove the set screws which secure the attenuator assembly (see figure 4-9) to the coupling of the attenuator dial. Remove the four screws from connector J-103, and unsolder wire on terminal of assembly of which connector J-103 is a part. Loosen the set screws on the coupler which secures the frequency selector switch to the frequency dial, and carefully remove the r-f output chassis from the main chassis.

e. (See figure 4-9.) To remove board assemblies, oscillator assembly, mixer assembly, or filter assembly, proceed as follows. Tag all electrical leads prior to removal. This will insure proper re-connection upon replacement. Remove the corresponding attaching hardware and separate the items from chassis. It will not normally be necessary to remove the complete board assemblies to effect replacement of individual parts. In the case of the board assembly mounted on the audio mixer assembly, it may be necessary to loosen the three nuts which secure the board in order to gain access to parts located on the opposite side. To remove the gear train assembly, remove the set screws which secure the gear train assembly to coupling, remove the two screws and four washers which secure the gear train assembly to the r-f output chassis, and lift the gear train assembly from the unit.

f. Gain access to the internal components of the r-f exciter chassis as follows. (See figure 4-10.) Remove the 13 screws and washers. Remove the screw which passes through the end of the box cover and into spacer, and remove nut and washer from stud. Separate the box cover from chassis. Access to all internal parts of the r-f exciter chassis should now be available. Removal of all components within the r-f exciter chassis should be obvious since the majority of components are soldered in place. However, prior to removal of electronic parts, the leads of such items should be tagged or marked in some manner to insure proper connection upon replacement.

g. Gain access to the internal components of the r-f output chassis as follows. (See figure 4-11.) Remove the 11 screws and washers. Remove gear and cover plate directly below the gear. Remove nut and shield plate mounted on switch S-301. Separate the box cover from the chassis. Access to all internal parts of the r-f output chassis should now be available. As in the case of the r-f exciter chassis, removal of all components within the r-f chassis should be obvious. Make certain to tag or mark electronic parts prior to removal. To separate the attenuator assembly (see figure 4-9) from the box cover, remove the large coupling nut which secures the attenuator cylinder to the cover end, remove the two screws and washers which secure the attenuator support to the cover, and lift the attenuator assembly from the box cover.

CAUTION

Do not attempt to disassemble the attenuator assembly. This unit contains resistors which are precision ground at the factory. If the attenuator assembly is defective, the entire assembly should be replaced as a unit.

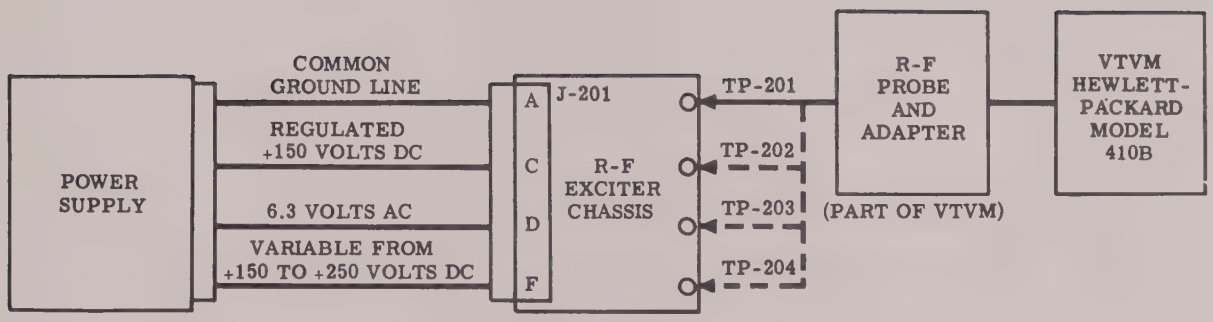


Figure 4-5. Bench Test Diagram for Preliminary Alignment of R-f Exciter Subassembly

h. Disassembly of the subassemblies and board assemblies shown in figures 4-12 through 4-16 is obvious and merits no special discussion. In most cases individual electronic parts will be removed from the board assemblies and subassemblies while such assemblies are secured to the main chassis. No particular precautions need be observed in removing electronic parts except that wiring should be identified by means of tags or pencil sketches prior to removal.

4-17. REASSEMBLY OF THE SIGNAL GENERATOR BSG-7. Reassemble the component parts of the Signal Generator in the reverse order of the disassembly procedures.

4-18. ALIGNMENT AND ADJUSTMENTS.

4-19. GENERAL. The subsequent paragraphs describe detailed alignment procedures for the Signal Generator. The r-f exciter chassis and the r-f output chassis assemblies form the basic assemblies of the Signal Generator therefore alignment of these assemblies will be described initially. In order that the subsequently described alignment procedures may be performed correctly, it is necessary that these two assemblies be removed from the major component assembly.

4-20. TESTING AND PRELIMINARY ALIGNMENT OF THE R-F EXCITER CHASSIS. Proceed as follows to test and align the r-f exciter chassis.

a. Connect receptacle J-201 on the r-f exciter chassis to the power source as shown in figure 4-5. Adjust the variable B+ power source to approximately +150 volts dc.

b. Connect a VTVM to test point TP-201 as shown in figure 4-5. The location of TP-201 and all other test points and adjustment controls described in this paragraph are shown in figure 4-8. Adjust the VTVM to measure negative d-c voltage.

c. Adjust capacitors C-208, C-212, C-213, inductance L-204, capacitors C-219, C-220, inductance L-206, and capacitor C-224 (in that order) until maximum indication is obtained on the VTVM connected to TP-201.

d. Move the VTVM to test point TP-202. Adjust inductance L-208 and capacitor C-228 (in that order) until maximum indication is obtained on the VTVM connected to TP-202.

e. Move the VTVM to test point TP-203. Adjust capacitors C-231 and C-233 (in that order) until maximum indication is obtained on the VTVM connected to TP-203.

f. Move the VTVM to test point TP-204. Adjust capacitors C-234 and C-236 (in that order) until maximum indication is obtained on the VTVM connected to TP-204.

g. Remove the VTVM from TP-204. Connect a No. 49 light bulb to connector receptacle J-202 on the exciter chassis. Adjust capacitor C-238 until maximum brilliance is obtained in the light bulb.

h. In turn, connect the VTVM to test points TP-201, TP-202, TP-203 and TP-204. Raise the variable B+ power source to approximately +250 volts dc. The following negative bias voltages should be obtained at corresponding test points: TP-201 -2.0 to -4.0 volts dc, TP-202 -3.0 to -5.0 volts dc, TP-203 -3.0 to -4.0 volts dc, TP-204 -3.0 to -4.5 volts dc. Also, the light bulb connected to J-202 should illuminate to normal brilliance.

i. This completes preliminary alignment and test of the exciter chassis. The unit can now be removed from the test equipment and installed within the major component.

4-21. TESTING AND PRELIMINARY ALIGNMENT OF THE R-F OUTPUT CHASSIS. Proceed as follows to test and align the r-f output chassis.

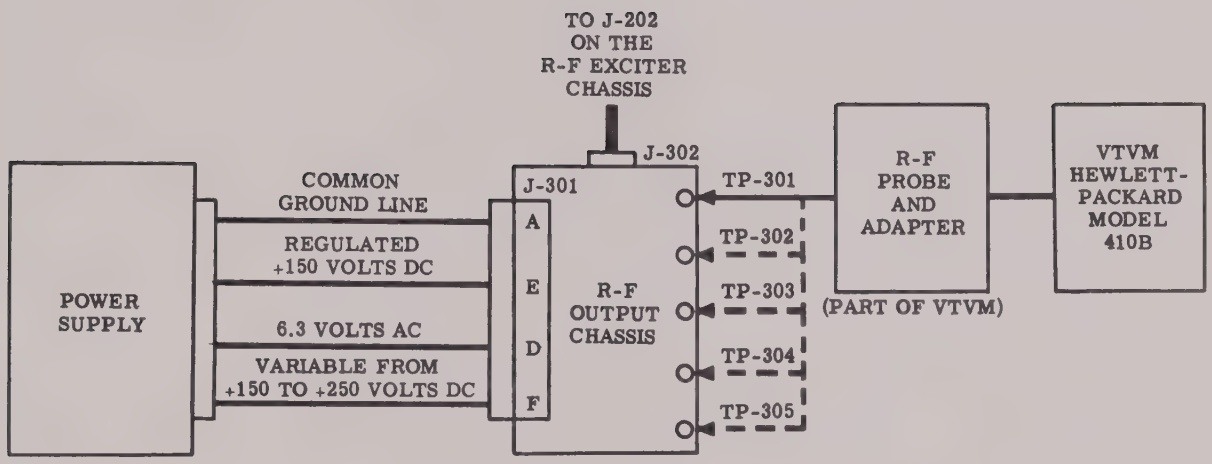


Figure 4-6. Bench Test Diagram for Preliminary Alignment of R-f Output Subassembly

a. (See figures 4-6 and 4-8.) Connect the output from the exciter chassis at J-202 to the mixer input of the r-f chassis at J-302. Apply power to the exciter chassis. The exciter can be replaced on the main chassis or can be connected to a second variable power source, whichever is convenient.

b. Connect receptacle J-301 on the r-f chassis to the variable power source as shown in figure 4-6. Adjust the variable B+ power source to approximately +150 volts dc.

c. Connect a VTVM to test point TP-301 as shown in figure 4-6. The location of TP-301 and all other test points and adjustment controls described in this paragraph are shown in figure 4-8. Adjust the VTVM to measure negative d-c voltage.

d. Rotate the crystal selector switch S-301 to the seventh position. This position corresponds to a 413 megacycle r-f output at the final stage of the r-f chassis.

e. Rotate the adjustment slug of inductance L-301 full counterclockwise (minimum inductance). Adjust inductance L-302 until maximum indication is obtained on the VTVM connected to TP-301. If no indication is readily obtained at TP-301, increase the inductance of L-301 (rotate adjustment slug clockwise). If no VTVM indication is obtained after adjustment of L-301, the corresponding crystal is probably defective and should be replaced.

f. Move the VTVM to test point TP-302. Adjust inductance L-304, and capacitor C-311 (in that order) until maximum indication is obtained on the VTVM connected to TP-302.

g. Move the VTVM to test point TP-303. Adjust capacitor C-312, inductance L-307, capacitor C-317 and C-237 or r-f exciter strip (in that order) until maximum indication is obtained on the VTVM connected to TP-303.

h. Move the VTVM to test point TP-304. Adjust capacitors C-318 and C-321 (in that order) until maximum indication is obtained on the VTVM connected to TP-304.

i. Move the VTVM to test point TP-305. Adjust capacitors C-322 and C-323 (in that order) until maximum indication is obtained on the VTVM connected to TP-305.

j. In turn, connect the VTVM to test points TP-301, TP-302, TP-303, TP-304, and TP-305. Raise the variable B+ power source to approximately +250 volts dc. The following negative bias voltages should be obtained at corresponding test points: TP-301 -0.7 to-1.8 volts dc, TP-302 -0.5 to -1.0 volts dc, TP-303 -1.0 to -2.0 volts dc, TP-304 -4.5 to -5.5 volts dc, TP-305 approximately -2.0 volts dc.

k. Connect the VTVM to test point TP-301. Rotate the crystal selector switch S-301,to each of its 15 positions and observe the VTVM. If crystal oscillator V-301 drops out of oscillation at any one of the positions, quickly adjust inductance L-302 to restore oscillation. Slight adjustment of inductance L-301 can also be accomplished to restore oscillation. If either inductance must be seriously detuned from the previously established points for any particular position of S-301, the corresponding crystal is probably defective and should be replaced.

CAUTION

When performing step k of this paragraph using external variable power supply, do not permit the r-f chassis electron tubes to operate at full plate voltage with no r-f drive from the crystal oscillator for any length of time. The absence of grid bias, which is developed by the r-f drive, could cause serious damage to the electron tubes. If the crystal oscillator drops out of oscillation at any position of S-301 and oscillation can not be

restored immediately by adjustment of L-302 and L-301, reduce the variable B+ potential to approximately +150 volts dc. Also, do not apply plate power to the r-f chassis electron tubes unless the r-f signal from the exciter chassis is available at receptacle J-302. Absence of this signal will also cause a loss of bias which could result in damage. When alignment of the r-f chassis is accomplished using the generator power supply with P-303 connected, automatic protection due to loss of drive is provided by the operation of relay K-301 which lowers the plate voltage to the r-f chassis from +250 volts dc to approximately +150 volts dc.

l. This completes preliminary alignment and test of the r-f output chassis. The unit can now be removed from the test equipment and installed within the major component.

4-22. ADJUSTMENT OF INTERNAL MODULATION OSCILLATOR FREQUENCIES. Proceed as follows to adjust the internal modulation oscillator frequencies.

a. Loosen the 14 captive panel screws and remove the signal generator case. Place the Signal Generator on its side so that capacitors C-108, C-111, C-114, C-117, C-120 and C-123 are accessible. (See figure 4-9.)

b. Repeat steps c through e of paragraph 4-5.

c. Connect a frequency meter, type AN/USM-26 to the A.F. MONITOR receptacle J-104 as shown in figure 4-2.

d. Position the MODULATION switch to INT.

e. Position MODULATION CHANNEL switch No. 1 upward. Operate the frequency meter controls as necessary to measure frequency of the a-f output from J-104.

f. With MODULATION CHANNEL switch No. 1 positioned upward, the indicated frequency must be within the limits of 7425 to 7575 cycles per second. If not, adjust trimmer capacitor C-123 until the correct frequency is obtained.

g. In turn, position MODULATION CHANNEL switch numbers 2, 3, 4, 5, and 6 upward. Operate the frequency meter controls as necessary to measure frequency of the a-f output from J-104. If any one or more of the frequencies is not within the high and low limit tolerances specified in Table 4-2 adjust the corresponding trimmer capacitors until the correct frequencies are obtained. The modulation oscillator frequencies are controlled by the following trimmer capacitors: 7500 cps by C-123, 8460 cps by C-120, 9540 cps by C-117, 10760 cps by C-114, 12140 cps by C-111, 13700 cps by C-108. This completes adjustment of the modulation oscillator frequencies.

NOTE

The guaranteed accuracy of the modulation oscillators under all operating conditions ±1 percent. However, they can be adjusted within a very few cycles by means of the trimmer capacitors. If accuracy better than ±1 percent is required over long periods of time, the modulation oscillators should be continuously monitored during use.

4-23. ADJUSTMENT OF INTERNAL MODULATION OSCILLATOR OUTPUT LEVELS. Proceed as follows to adjust the internal modulation oscillator output levels.

a. Loosen the 14 captive panel screws and remove the signal generator case. Place the Signal Generator on its side so that potentiometers R-115, R-120, R-125, R-130, R-135 and R-140 are accessible. (See figure 4-9.)

b. Repeat steps c through e of paragraph 4-5.

c. Connect a VTVM to the A.F. MONITOR receptacle J-104 as shown in figure 4-2.

d. Position the MODULATION switch to INT.

e. Position MODULATION CHANNEL switch No. 1 upward. Operate the VTVM controls as necessary to measure amplitude of the a-f output from J-104.

f. With MODULATION CHANNEL switch No. 1 positioned upward, the amplitude must be 0.84 volts ac. If not, adjust potentiometer R-140 until 0.84 volts is obtained.

g. In turn, position MODULATION CHANNEL switch numbers 2, 3, 4, 5, and 6 upward. Observe the a-f voltage levels as indicated on the VTVM for each of the frequencies. The indications must be 0.84 volts ac in each case. If not, adjust the corresponding potentiometers until the correct voltage output is obtained. The modulation oscillator output levels are controlled by the potentiometers: 7500 cps by R-140, 8460 cps by R-135, 9540 cps by R-130, 10760 cps by R-125, 12140 cps by R-120, 13700 cps by R-115. This completes adjustment of the modulation oscillator output levels.

4-24. ADJUSTMENT TO OBTAIN PROPER FREQUENCY DEVIATION LINEARITY. Align the equipment to obtain proper frequency deviation linearity as follows.

a. Remove the Signal Generator from its case and place it on a suitable work bench.

b. Connect the accessory power cable to receptacle J-105 and to a source of 115 volts ac, 50 to 1000 cycle power.

c. Position the POWER switch to ON and note that the POWER pilot lamp illuminates.

d. After a warm-up period of approximately five minutes, position the CARRIER switch to on and note that the CARRIER lamp illuminates.

e. Rotate the FREQUENCY knob until 406 is directly below the MC index marker.

f. Rotate the inner carrier output dial clockwise until an indication is obtained on the RF OUTPUT meter.

g. Rotate the OUTPUT TUNING knob as necessary to obtain a peak indication on the RF OUTPUT meter.

h. Rotate the inner carrier output dial until the RF OUTPUT meter needle is aligned with the red SET 100K index mark.

i. Adjust the fiducial ring of the carrier output dial until its index mark is aligned with the inner carrier output dial 100K (100,000 microvolts) mark.

j. Connect the R.F. OUTPUT receptacle J-103 to the input of a test receiver. Connect the receiver output to a panoramic adapter. Connect all test equipment as shown in figure 4-3. Use the accessory cables as necessary.

k. Tune the receiver to the r-f carrier output frequency of the generator as selected by the FREQUENCY knob. Adjust the inner carrier output dial and controls on the receiver and panoramic adapter as necessary until a single unmodulated signal is observed at the center of the panoramic adapter screen.

l. Rotate the DEVIATION knob and potentiometer R-164 full counterclockwise. See figure 4-9 for location of potentiometer R-164. Position the MODULATION switch to INT. Position MODULATION CHANNEL switch No. 1 upward.

m. Rotate the DEVIATION knob fully clockwise. Connect a VTVM to TP-101 and ground. Adjust potentiometer R-140 for a reading of 1.5 volt RMS at TP-101.

n. Adjust potentiometer R-145 so that the DEVIATION meter reads full scale.

o. Position MODULATION CHANNEL switch No. 1 to the off position, operate MODULATION CHANNEL switch No. 2, and adjust potentiometer R-135 for a reading of 1.5 volts RMS at TP-101.

p. Repeat step o of this paragraph for **MODULATION CHANNEL** switch No. 3 adjusting R-130, **MODULATION CHANNEL** switch No. 4 adjusting R-125, **MODULATION CHANNEL** switch No. 5 adjusting R-120, and **MODULATION CHANNEL** switch No. 6 adjusting R-115.

q. With **MODULATION CHANNEL** switch No. 6 positioned to on and the **DEVIATION** knob fully clockwise, connect the **VTVM** to pin 1 of XV-102 and ground.

r. Adjust R-164 to read 0.125 volts **RMS** on the **VTVM**.

s. Remove the **VTVM** from pin 1 of XV-102 and operate the **DEVIATION** knob until the **DEVIATION** meter reads red line ±300 kc.

t. A frequency modulated signal will appear on the panoramic adapter when connected as shown in figure 4-3. Adjust C-208, C-212, and C-213 located on the r-f exciter chassis for minimum modulation. The pattern observed on the panoramic adapter will be only the carrier. Capacitors C-212 and C-213 should be adjusted a small amount each time, maintaining close balance between the two. This can be determined by the position of the screwdriver slots on the capacitors.

u. With the deviation meter set to red line ±300 kc and with the 13,700 cps modulation switch on, adjust C-208 until 7-1/8 carrier disappearances are observed on the panoramic adapter.

v. Position the modulation switch to EXT. Connect a frequency meter to **A.F. MONITOR** receptacle J-104. Connect all test equipment as shown in figure 4-3. Use accessory cables as necessary.

w. Operate controls on the a-f oscillator connected to J-102 until an indication of 78,288 cps is obtained on the frequency meter connected to J-104.

x. With the **DEVIATION** meter reading red line ±300 kc adjust C-212 and C-213 for

1-1/2 carrier disappearances. Carefully maintain a balanced condition between C-212 and C-213.

NOTE

1-1/2 carrier disappearances is closely equivalent to 1 disappearance of the first side bands and the first side bands can be used instead of the carrier. The disappearance of the side band is sharper and can be detected easier than the 1-1/2 disappearances of the carrier.

y. Operate controls on the a-f oscillator connected to J-102 until an indication of 7500 cps is obtained on the frequency meter connected to J-104. Slowly rotate the **DEVIATION** knob clockwise and observe the r-f carrier signal on the panoramic adapter screen. Count the number of carrier disappearances as the DEVIATION knob is rotated. With 7500 cps modulation, the carrier should disappear 13 times for ±300 KC deviation.

z. Repeat step y of this paragraph using each of the seven external modulation frequencies specified in Table 4-3. The correct number of carrier disappearances must be obtained for each of the modulation frequencies as specified in Table 4-3.

aa. Remove the connection between the R.F. OUTPUT receptacle J-103 and the receiver input. Temporarily position the CARRIER switch to OFF. Remove the coaxial cable plug P-202 from receptacle J-202 on the exciter chassis. Connect an accessory tee adapter to J-202. Re-connect P-202 to one side of the tee adapter. Connect the opposite side of the tee adapter to the test oscillator. This connection should also be made with a tee adapter. Connect the opposite side of the test oscillator tee adapter to the test receiver. Connect all test equipment as shown in figure 4-4. Use the accessory cables as necessary. Position the CARRIER switch to ON.

bb. Tune the test receiver to the difference frequency of the r-f exciter and the test oscillator. This frequency should be approximately 9.8 megacycles. Advance the receiver crystal selector to sharp position 4 in order to increase selectivity of the receiver. Leave the MODULATION switch positioned to EXT. Rotate the DEVIATION knob full counterclockwise.

cc. Operate controls on the a-f oscillator connected to J-202 until an indication of 6039 cps is obtained on the frequency meter connected to J-104.

dd. Slowly rotate the DEVIATION knob clockwise and observe the r-f carrier signal on the S meter of the test receiver. Count the number of carrier disappearances as the DEVIATION knob is rotated clockwise. With 6039 cps modulation, the carrier should disappear two times for ±300 kilocycles deviation.

ee. Repeat step dd of this paragraph using each of the five external modulation frequencies specified in Table 4-4. The correct number of carrier disappearances must be obtained for each of the modulation frequencies as specified in Table 4-4.

4-25. ADJUSTMENT OF RF OUTPUT METER M-102 CIRCUIT. Proceed as follows to adjust the RF OUTPUT meter M-102 circuit.

a. Repeat steps a through i of paragraph 4-24.

b. Connect a VTVM to the R.F. OUTPUT receptacle J-103 as shown in figure 4-1. Rotate the inner carrier output dial to 100K. Operate the VTVM controls as necessary to measure the r-f output level from J-103.

c. With the inner carrier output dial positioned to 100K and the R.F. OUTPUT meter needle aligned with the 100K index mark, the indicated level on the VTVM must be 100,000 microvolts ±10 percent. If not, adjust the inner carrier output dial to obtain 100,000 microvolts on the VTVM, and then adjust potentiometer R-170

until the R.F. OUTPUT meter needle is aligned with the 100K index mark. The location of potentiometer R-170 is shown in figure 4-8. Make certain that the OUTPUT TUNING knob has been adjusted for peak indication on the R.F. OUTPUT meter before setting R-170.

4-26. FINAL ADJUSTMENT OF R-F OUTPUT FREQUENCIES. Proceed as follows to adjust the r-f output frequencies.

a. Repeat steps a through i of paragraph 4-24.

b. Connect an r-f frequency meter to the R.F. OUTPUT receptacle J-103 as shown in figure 4-1. Rotate the inner carrier output dial as necessary to obtain an indication on the frequency meter. Operate frequency meter controls as necessary to measure frequency of the r-f output from J-103.

c. With the FREQUENCY knob adjusted to 406 megacycles, the indicated frequency must be within the limits of 405.9594 to 406.0406 megacycles.

d. Repeat steps a through c of this paragraph, checking each frequency in turn from 406 to 420 megacycles. The high limit and low limit tolerances for each of the 15 r-f frequencies are tabulated in Table 4-1. The frequencies indicated on the frequency meter must be within the specified tolerances.

NOTE

As outlined in subparagraph c of paragraph 4-10, trouble can be localized to one of two major causes if the r-f output frequencies are not within tolerance. If only one or two frequencies are out of tolerance, the trouble may be caused by a defective crystal Y-301 through Y-315. Refer to the trouble shooting chart of Table 5-1, if such trouble occurs. If all frequencies are out of

tolerance or nearly out of tolerance, the most likely cause of trouble is a crystal Y-201 which is out of tolerance, or near the tolerance edge. Variable capacitor C-249 is incorporated in the Y-201 circuit to correct such a condition. Adjustment of C-249 shifts all of the output frequencies in a given direction and by the same amount. Therefore, if all frequencies are out of tolerance in one direction, C-249 can be adjusted to bring the frequencies within tolerance. If this does not correct the trouble, substitute a new Y-201 crystal. In some cases, it may be necessary to split the difference between extreme high and low frequencies. However, if one or two frequencies remain out of tolerance after C-249 has been so adjusted to split the difference, the corresponding crystals Y-301 through Y-315 should be substituted. After substitution of any crystals, or adjustment of any controls on either subassembly, it is of absolute importance that all 15 frequencies be checked to insure that they are within tolerance.

4-27. CLEANING AND LUBRICATION.

4-28. CLEANING.

4-29. Materials necessary to clean the Signal Generator include a quantity of lint-free dry cloth, carbon tetrachloride (Federal Specification O-C-141 or equivalent), and a small bristle brush for reaching narrow and normally inaccessible areas of the chassis and parts. Inflammable substances such as gasoline or dry cleaning solvent should not be substituted for carbon tetrachloride.

4-30. The only exterior parts of the Signal Generator that normally require cleaning are the connector receptacles. Such items should be cleaned by removing dust, dirt, corrosion or other foreign material. Employ a brush dipped in carbon tetrachloride for such cleaning. To prevent shorts or possible flashover, remove foreign material between the pins of the connector receptacles. Finish all surfaces with a dry cloth.

4-31. Electronic components of the Signal Generator should be cleaned as follows. Electron tubes should be cleaned with a damp, dust-free cloth and finished with a dry cloth. Dirty sockets and socket pins should be cleaned carefully with a cloth or a bristle brush moistened with carbon tetrachloride. Capacitors, resistors, transformers, filter chokes, terminal boards, and miscellaneous electronic parts should be cleaned with a damp, dust-free cloth and finished with a dry cloth. Dirty or corroded contacts or terminals of such items should be cleaned with a cloth or bristle brush moistened with carbon tetrachloride. Wiring and connections must be cleaned of dirt or corrosion.

4-32. Mechanical parts of the Signal Generator will not normally require cleaning unless they have been exposed to excessive moisture or dust. If any mechanical parts are found to be dirty, they should be wiped clean with a dry lint-free cloth. If there is evidence of corrosion on any mechanical part, it should be replaced.

NOTE

Since the interior of the Signal Generator is sealed during normal operation, the need for cleaning is minimized. However, since the Signal Generator may be used for preflight checks of various aircraft, it will be exposed to the elements. Therefore,

maintenance personnel should carefully check the external connector receptacle pins and contacts for an accumulation of dust, dirt, moisture or corrosion. The connector receptacles must be cleaned thoroughly to prevent high resistance shorts between pins and contacts.

4-33. LUBRICATION.

4-34. The only parts of the Signal Generator that require lubrication are the attenuator assembly AT-301 gears and shaft, and the OUTPUT TUNING shaft. (See figure 4-9.) Both shafts should be lubricated with graphite-petrolatum compound (Federal Specification MIL-C-5544 or equivalent) at the points where the shafts pass through the front panel. The AT-301 gears should be lubricated with grease (Specification MIL-G-3278 or equivalent). Apply a thin film of grease to all gear teeth and faces. Lubrication should be accomplished at 300 to 400 hour intervals or at overhaul.

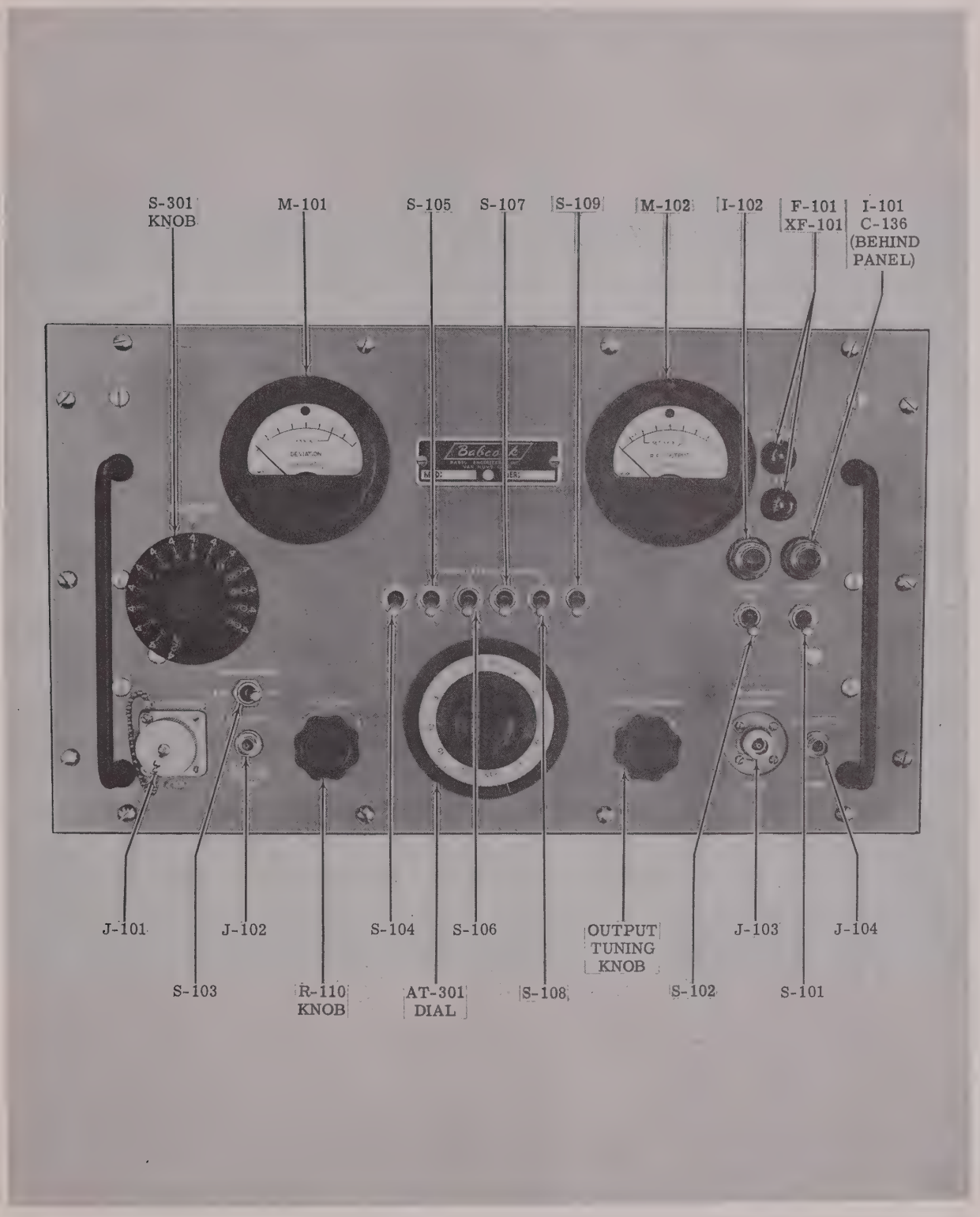


Figure 4-7. Signal Generator BSG-7, Front Panel View, Component Locations

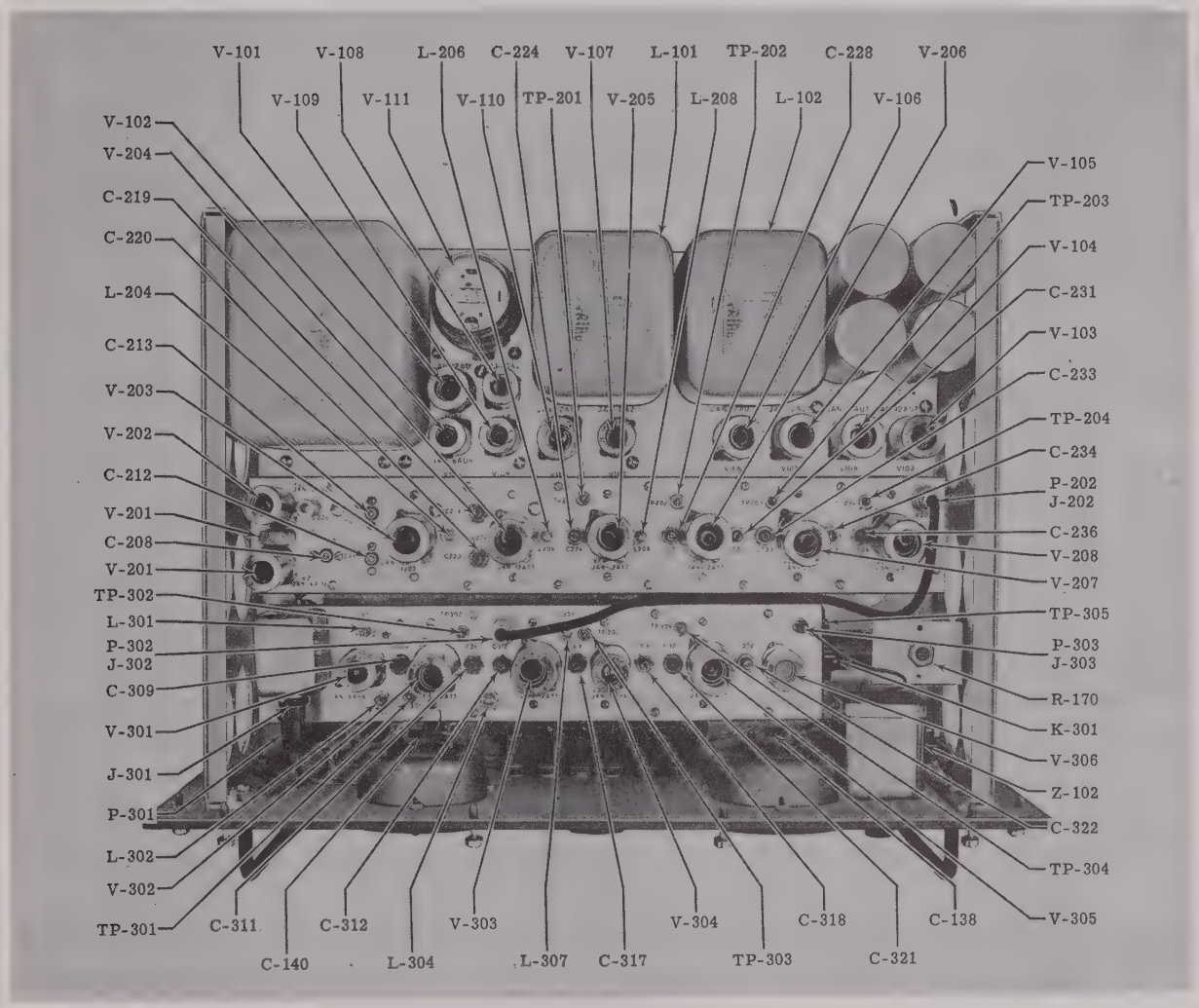


Figure 4-8. Signal Generator BSG-7, Top View, Component Locations

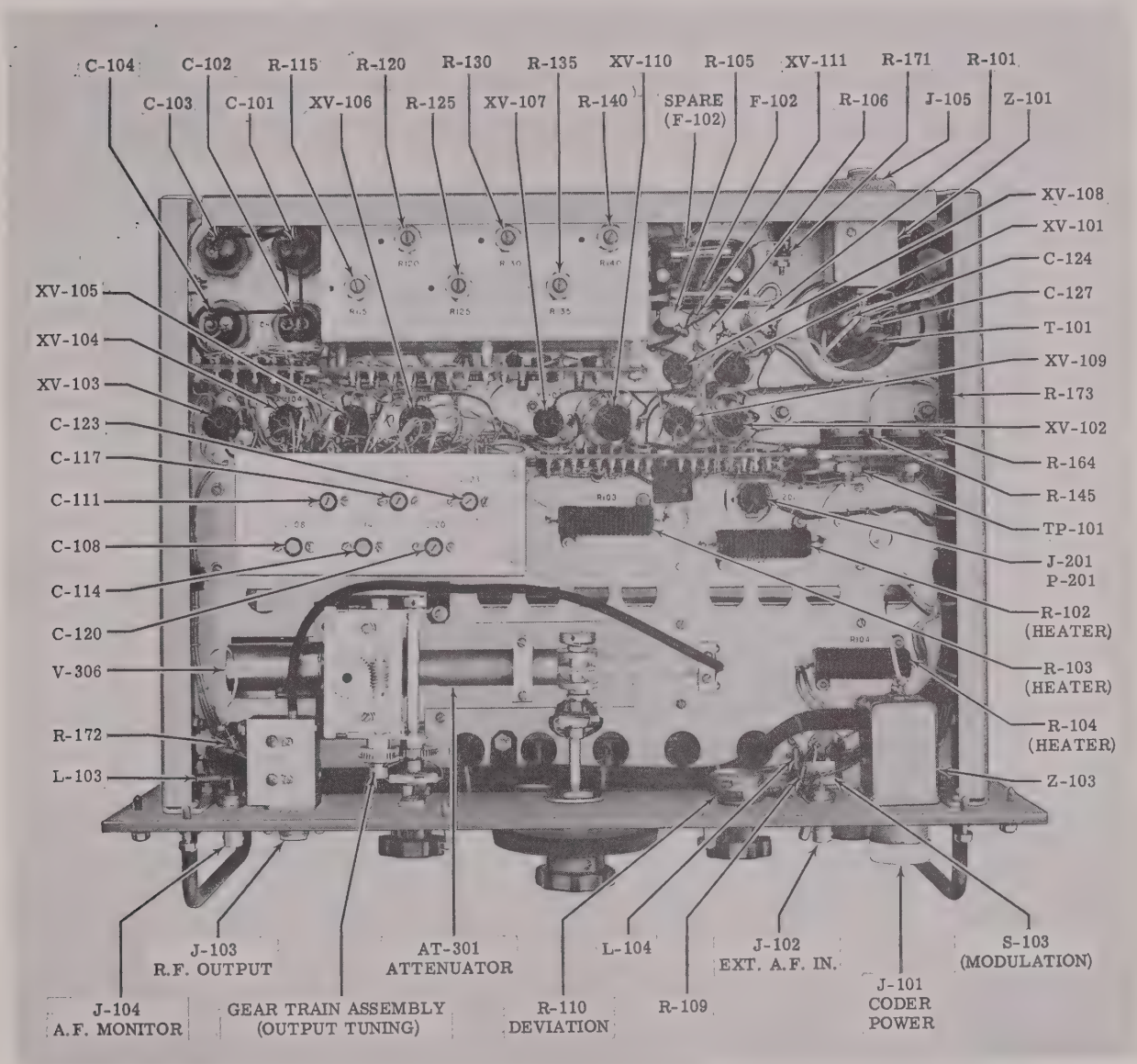


Figure 4-9. Signal Generator BSG-7, Bottom View, Component Locations

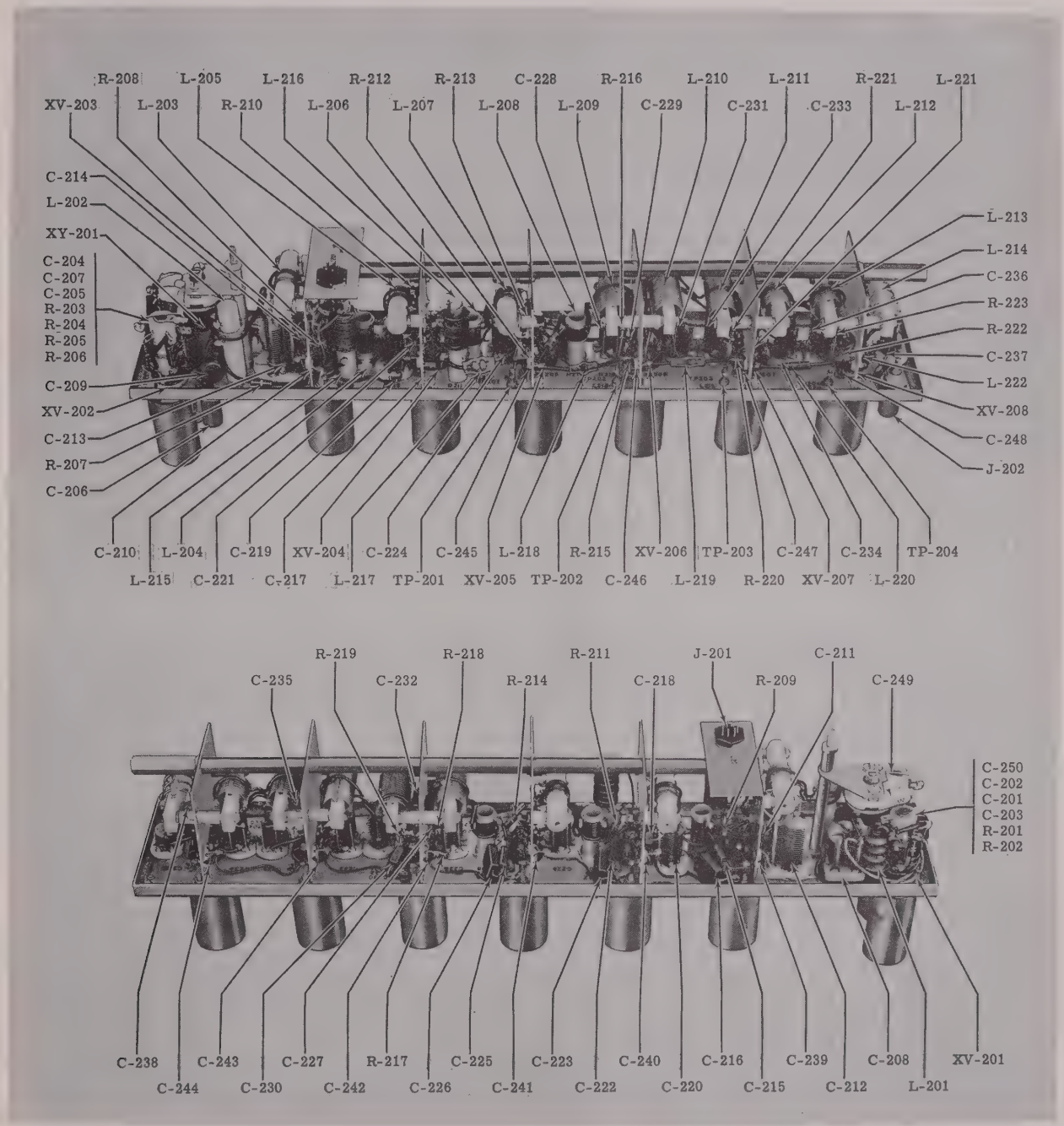


Figure 4-10. R-f Exciter Chassis, Component Locations

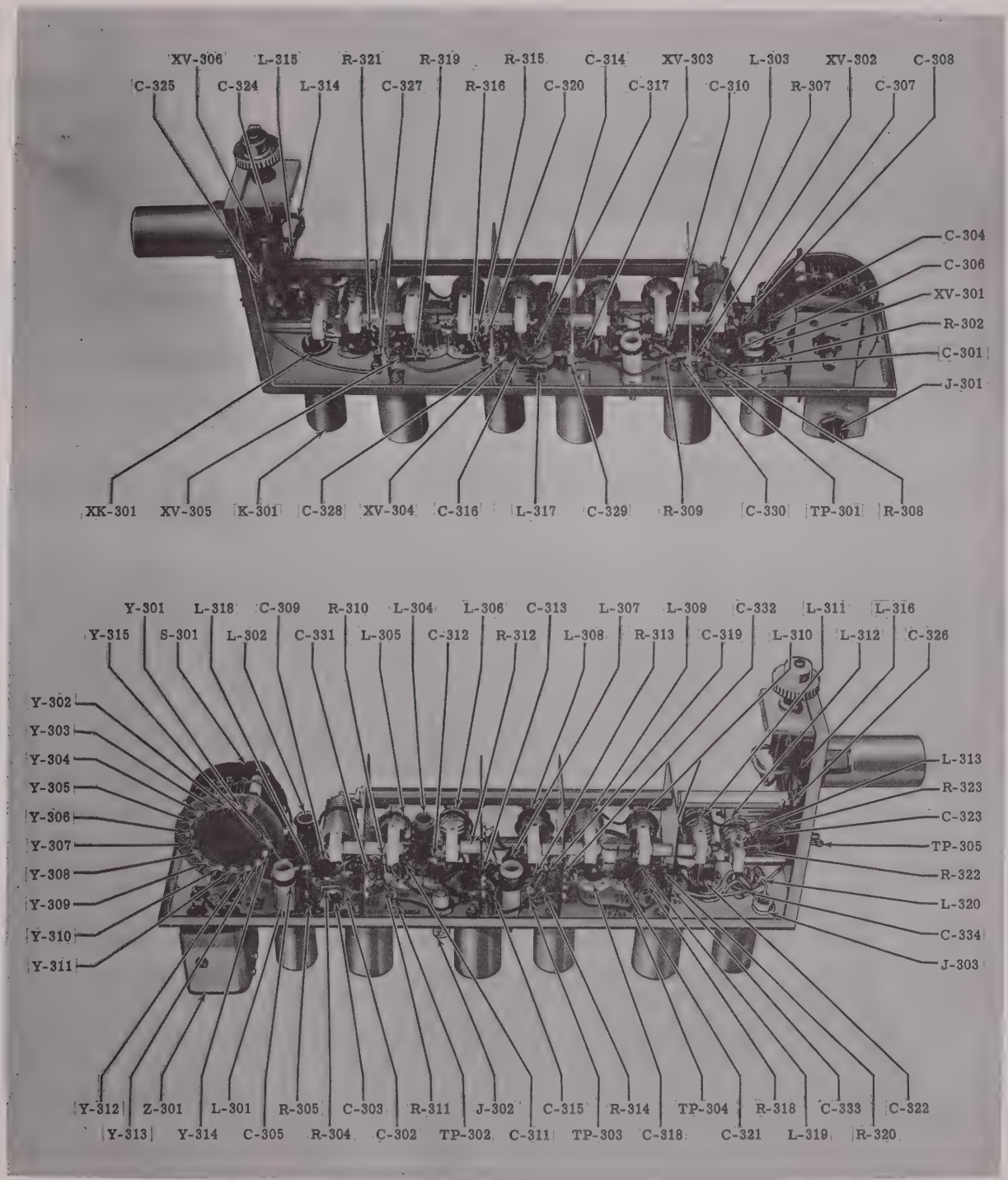


Figure 4-11. R-f Output Chassis, Component Locations

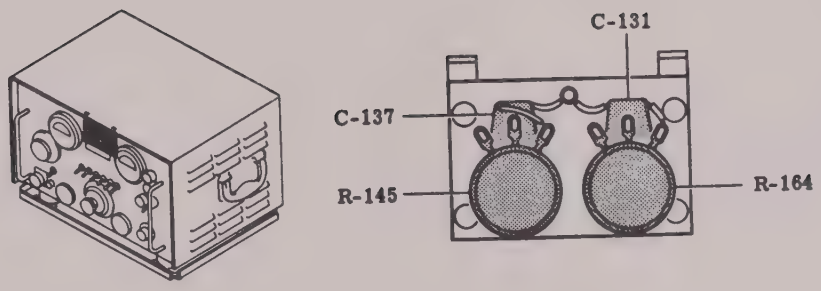


Figure 4-12. Gain Control Board Assembly, Component Locations

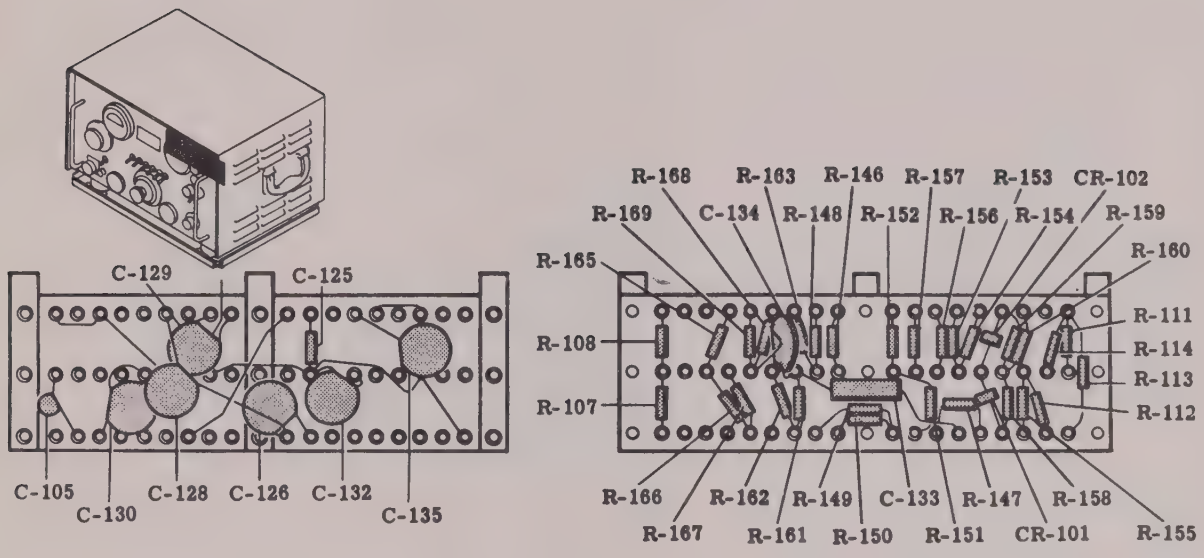


Figure 4-13. Metering Board Assembly, Component Locations

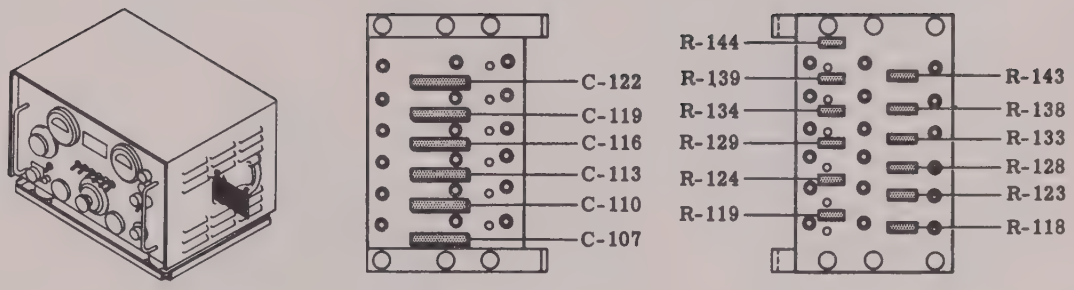


Figure 4-14. Grid Board Assembly, Component Locations

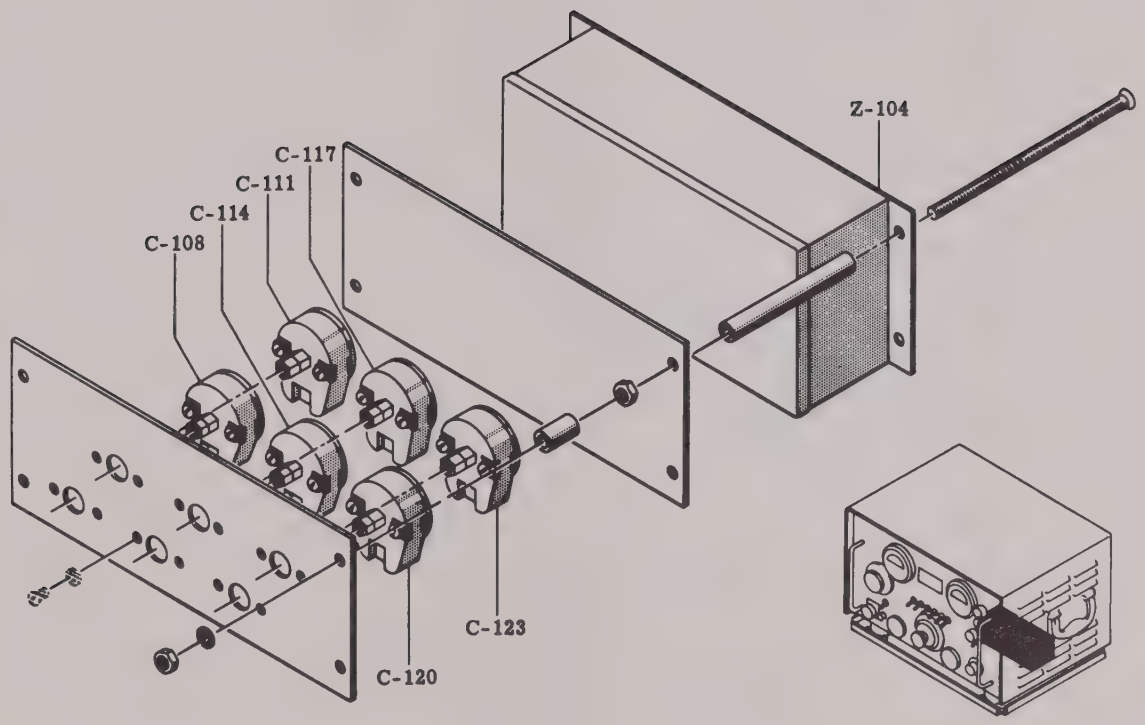
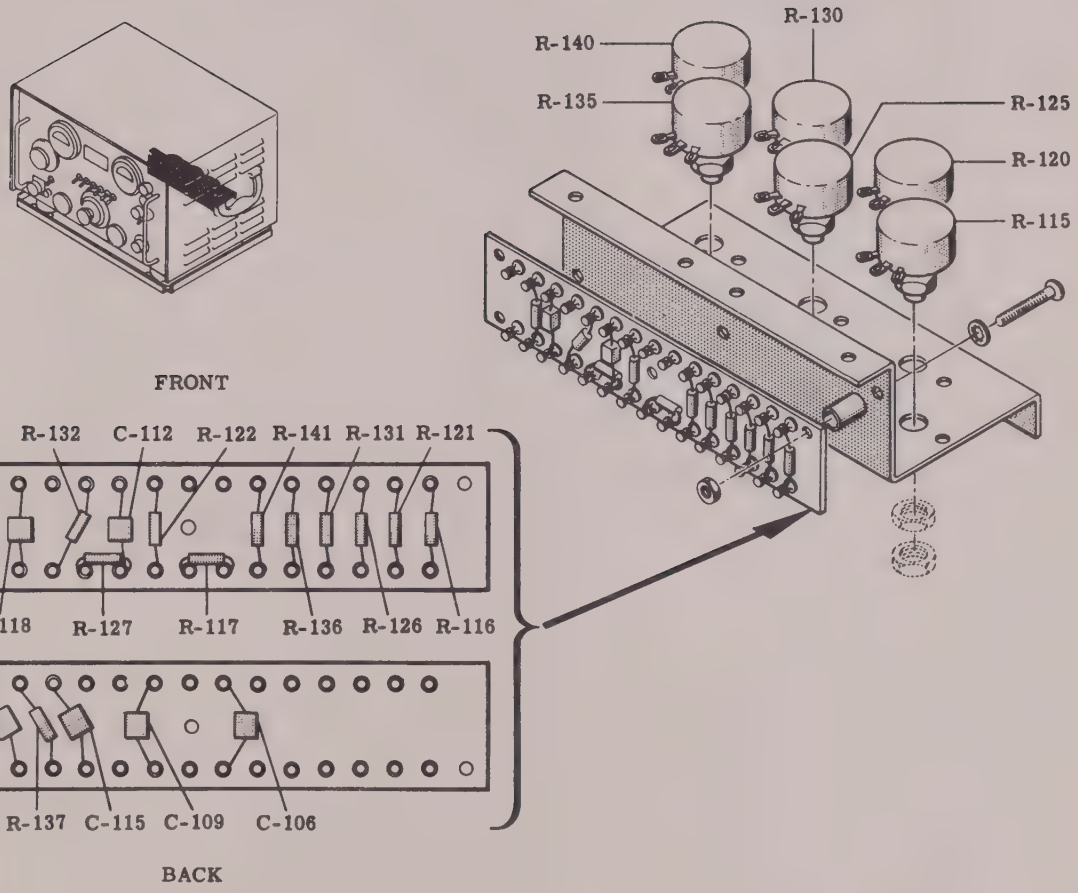


Figure 4-15. Audio Oscillator Assembly, Exploded View, Component Locations


R-140
R-135
R-130
R-125
R-120
R-115
FRONT
R-142
R-132
C-112
R-122
R-141
R-131
R-121
C-118
R-127
R-117
R-136
R-126
R-116
C-121
R-137
C-115
C-109
C-106
BACK

SECTION V

DIAGRAMS

5-1. GENERAL

5-2. This section contains diagrams which are required for proper servicing and overhaul of the subject equipment. A schematic wiring diagram, a terminal voltage diagram, a terminal resistance diagram, and a terminal resistance diagram for connectors are included in this section.

LIST OF DIAGRAMS

Figure	Title	Page
5-1	Signal Generator BSG-7, Schematic Wiring Diagram	76
5-2	Signal Generator BSG-7, Terminal Voltage Diagram	77
5-3	Signal Generator BSG-7, Terminal Resistance Diagram	78
5-4	Signal Generator BSG-7, Terminal Resistance Diagram for Connectors	79

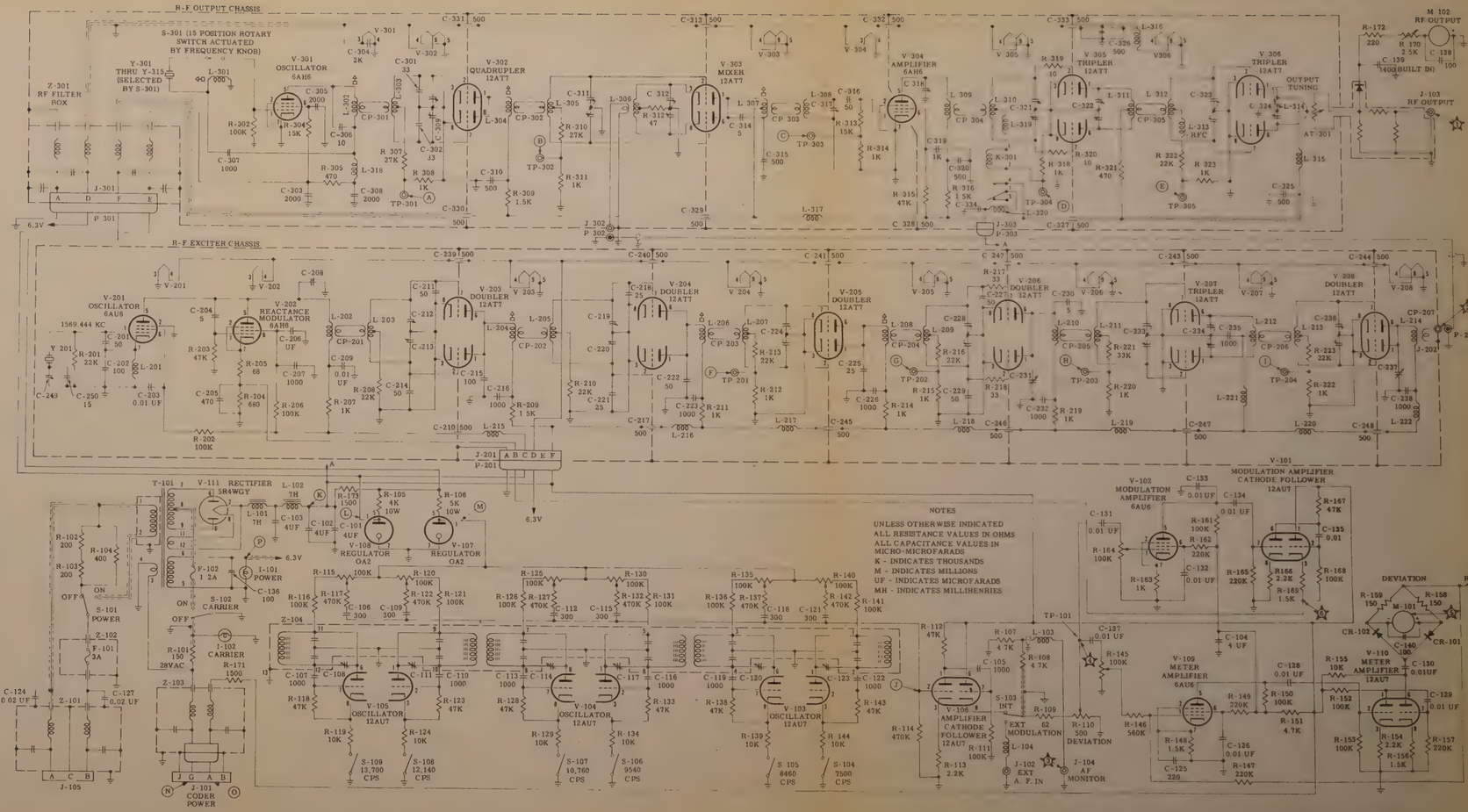
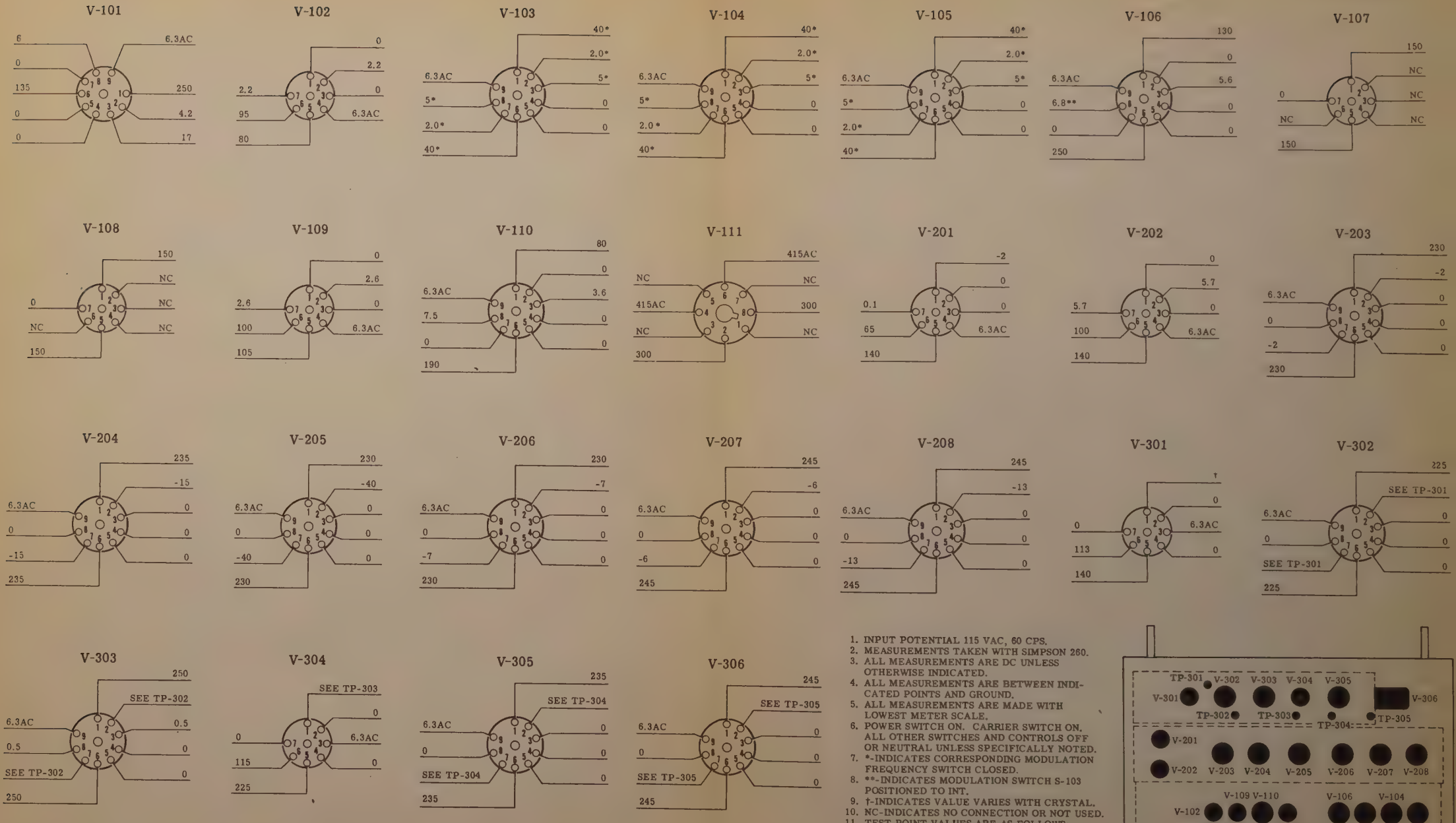


Figure 5-1. Signal Generator BSG-7, Schematic Wiring Diagram



1. INPUT POTENTIAL 115 VAC, 60 CPS.
2. MEASUREMENTS TAKEN WITH SIMPSON 260.
3. ALL MEASUREMENTS ARE DC UNLESS OTHERWISE INDICATED.
4. ALL MEASUREMENTS ARE BETWEEN INDICATED POINTS AND GROUND.
5. ALL MEASUREMENTS ARE MADE WITH LOWEST METER SCALE.
6. POWER SWITCH ON. CARRIER SWITCH ON. ALL OTHER SWITCHES AND CONTROLS OFF OR NEUTRAL UNLESS SPECIFICALLY NOTED.
7. *-INDICATES CORRESPONDING MODULATION FREQUENCY SWITCH CLOSED.
8. **-INDICATES MODULATION SWITCH S-103 POSITIONED TO INT.
9. †-INDICATES VALUE VARIES WITH CRYSTAL.
10. NC-INDICATES NO CONNECTION OR NOT USED.
11. TEST POINT VALUES ARE AS FOLLOWS:
    TP-301 -0.7 TO -1.8 VDC
    TP-302 -0.5 TO -1.0 VDC
    TP-303 -1.0 TO -2.0 VDC
    TP-304 -4.5 TO -5.5 VDC
    TP-305 APPROXIMATELY -2.0 VDC

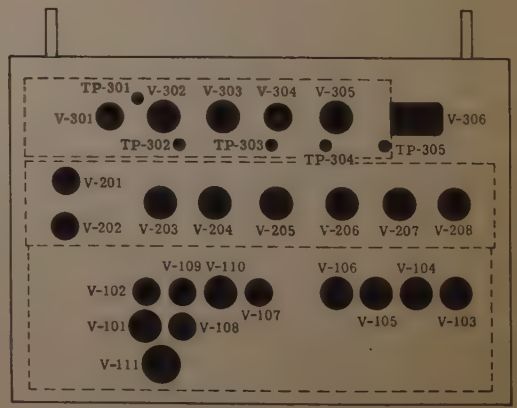
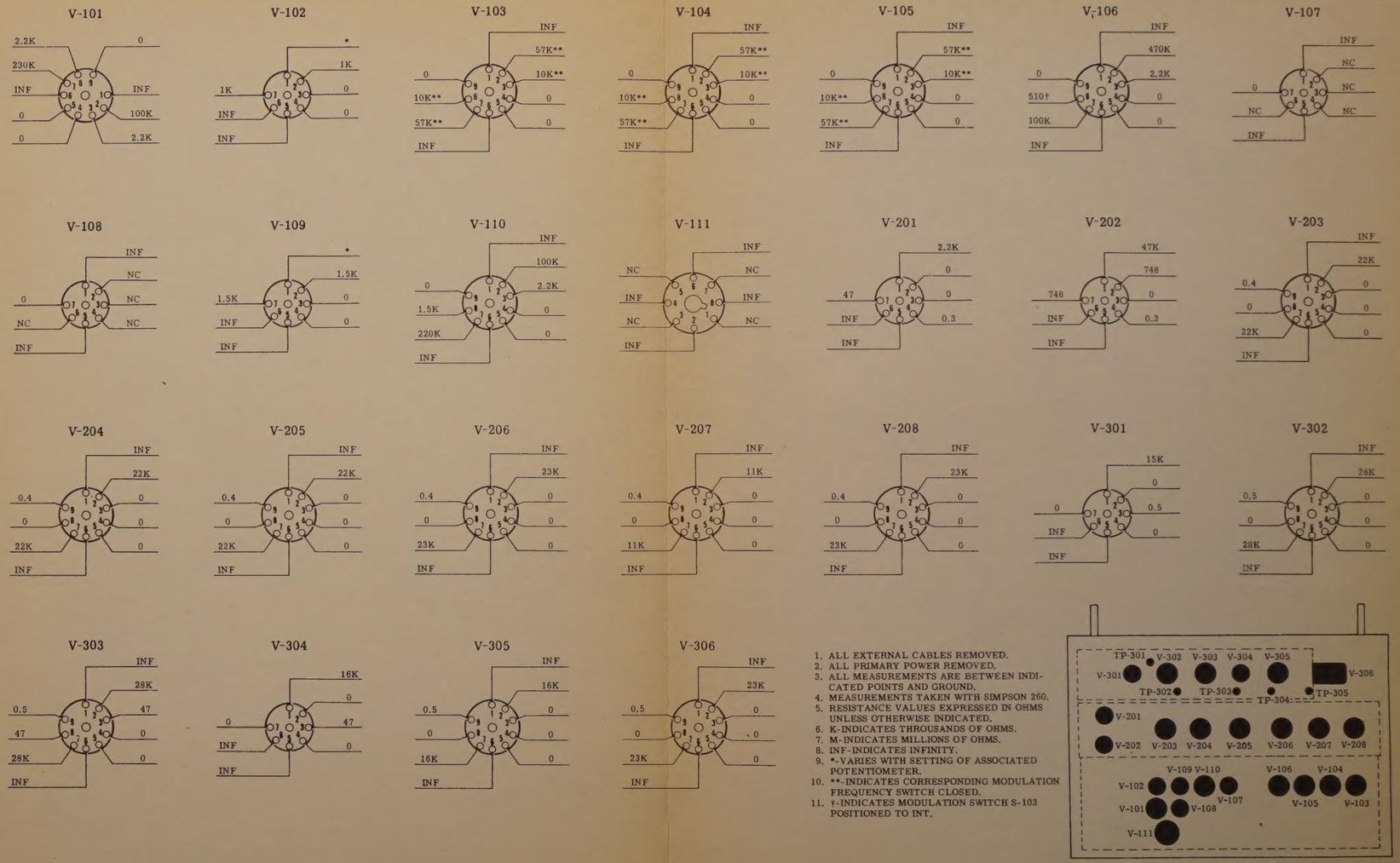


Figure 5-2. Signal Generator BSG-7, Terminal Voltage Diagram



1. ALL EXTERNAL CABLES REMOVED.
2. ALL PRIMARY POWER REMOVED.
3. ALL MEASUREMENTS ARE BETWEEN INDICATED POINTS AND GROUND.
4. MEASUREMENTS TAKEN WITH SIMPSON 260.
5. RESISTANCE VALUES EXPRESSED IN OHMS UNLESS OTHERWISE INDICATED.
6. K-INDICATES THROUSANDS OF OHMS.
7. M-INDICATES MILLIONS OF OHMS.
8. INF-INDICATES INFINITY.
9. *-VARIES WITH SETTING OF ASSOCIATED POTENTIOMETER.
10. **-INDICATES CORRESPONDING MODULATION FREQUENCY SWITCH CLOSED.
11. †-INDICATES MODULATION SWITCH S-103 POSITIONED TO INT.

Figure 5-3. Signal Generator BSG-7, Terminal Resistance Diagram

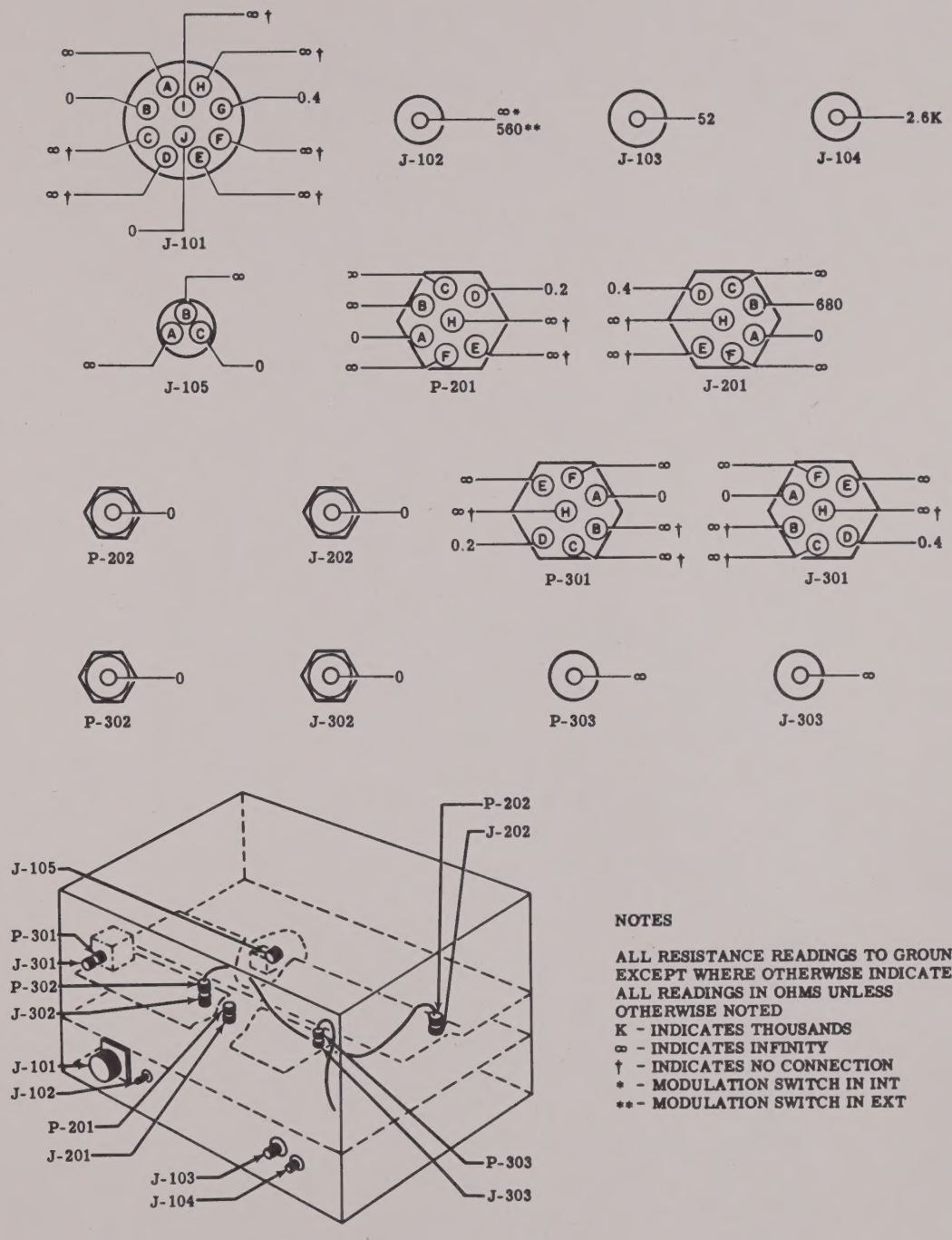


Figure 5-4. Signal Generator BSG-7, Terminal Resistance Diagram for Connectors